VAF INSTRUMENTS

Technical Manual

Instructions for installation, operation and maintenance

641

OILCON® MARK 6M

According regulation 31 Annex I of MARPOL 73/78,
IMO Resolution MEPC.108(49) and IMO Resolution MEPC.240(65)

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CONTENTS

1 PREFACE

1.1 GENERAL

The Oilcon® Oil Discharge Monitoring and Control System is used for monitoring and controlling the discharge of ballast water overboard. The system comprises the following main components:

- Oilcon® Oil Discharge Monitor
- Flowmeter system

The purpose of the Oilcon® Oil Discharge Monitor is to calculate and record:

- the instantaneous rate of discharge of oil, in litres per nautical mile
- the total quantity of oil discharge into the sea on each voyage
- and also to control the ship's overboard discharge system as necessary to reduce the possibility of discharging excessively oily water
- Oil content discharge

This manual contains instructions for installation, operation and maintenance (IOM) of the Oilcon® Oil Discharge Monitor and Control System.
For IOM information of associated equipment supplied by VAF Instruments, refer to the separate manual supplied with those products.
This manual contains important information for the installer, the operator and for your maintenance department.

NEVER USE THE EQUIPMENT OUTSIDE ITS SPECIFICATIONS OR BEYOND COMMON ENGINEERING PRACTICE NOR USE THE EQUIPMENT FOR OTHER APPLICATIONS OR MAKE CONNECTIONS TO OTHER EQUIPMENT THAN EXPLICITLY DESCRIBED IN THE ORDER ACKNOWLEDGEMENT AND/OR TECHNICAL MANUALS OF VAF INSTRUMENTS.

CAUTION:
TO ENSURE SAFE AND CORRECT INSTALLATION AND HANDELING, OPERATION AND MAINTAINING, READ THIS MANUAL COMPLETELY BEFORE INSTALLING THE EQUIPMENT AND STARTING OPERATIONS.

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Or your local authorized VAF dealer.
Their addresses can be found on www.vaf.nl

1.2 SYMBOLS

The following symbols are used to call attention to specific types of information.

A WARNING TO USE CAUTION!
IN SOME INSTANCES, PERSONAL INJURY OR DAMAGE TO THE OILCON® OIL DISCHARGE MONITORING AND CONTROL SYSTEM MAY RESULT IF THESE INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.

AN EXPLANATION OR INFORMATION OF INTEREST.

1.3 COPYRIGHT

2 PRODUCT DESCRIPTION

The Oilcon® Oil Discharge Monitoring and Control System continuously samples ballast water being discharged overboard and measures the oil content and controls the discharge of the ballast water and plays therefore a central role in the Oil Discharge Monitor and Control System.
A schematic arrangement of the entire Oilcon® Oil Discharge Monitoring and Control System is shown in drawing **0806-8035**.

2.1 PRINCIPLE OF OPERATION

The measurement technique used in the Oilcon® Oil Discharge Monitoring and Control System is based on scattered light. The sample of discharge water passes through a detector cell while light enters and leaves the measurement area of the cell. The sample flow is at right angles to the optical path. When no particles or oil droplets are present in the water, light can pass straight through the cell (Direct beam). When oil is present in the form of a homogeneous mixture, light is scattered at different angles (Scatter beam). The intensity of scattered light at a specific angle depends on the density of oil droplets and their particle size relative to the wavelength of radiation. The intensity of light of the direct beam decreases logarithmically with an increasing oil concentration, while the scatter beam increases linearly but passes through a maximum before decreasing logarithmically. The maximum occurs because of the increase in attenuation blocking out the scattered light at high concentrations. The variation of light refraction by oil droplets only is quite different to that refracted when solid contaminants are also present and this fact can be used to obtain an accurate indication of oil content whilst disregarding solid particles up to a point.

The light source used in the Oilcon® Oil Discharge Monitoring and Control System is a near infra red diode which is operated in a pulsed mode so that the average power dissipation is very low, although the intensity is high. The light signal is processed and transmitted along a signal cable from the detector cell to the EPU where the three detection signals are used to compute the oil concentration levels present in the sample passing through the detector cell.

The response in the optical detection is instantaneous and most of the delays when reading oil levels lie in the sampling pipework. High velocity, short sampling length and minimum pipework bends give fast response times. During periods of inactivity the pipework may become fouled and when the system is started up, erroneous readings could occur as oil is stripped from the pipework. Automatic sequential control of forward and backward flushing at start up and shut down of the monitor prevents erroneous readings and keeps the sampling lines clean. This also ensures reliable start up, minimises system deterioration and ensures that the pipework is left in clean condition prior to the next use of the monitor. At the end of the start up flushing cycle a system zero check is performed, this automatic zero setting compensates for any small deposits on the cell windows. The window wash pump cleans the cell windows at regular intervals.

All operating controls and system alarms are situated on the MCU. Manual system flush and window wash controls are available to make these two operations possible at any time. With the exception of selecting the sample point and the oil type, the system works automatically once sampling has been initiated. The oil level together with the discharge flow rate and ships speed are input to the MCU to give a permanent record of oil discharged overboard. Both calibration alarms and operational alarms are provided and the alarm philosophy employed follows normal marine practice. When a fault occurs, both audible and visual alarms are activated. The audible alarm can be silenced by fault acceptance but the visual alarm cannot be extinguished. It is only after the fault has been rectified that the visual alarm is extinguished. Should a second alarm occur during this sequence, both audible and the visual alarms would be reactivated.

2.2 PRODUCT CONFIGURATION

The Oilcon® Oil Discharge Monitoring and Control System comprises the elements labelled as:

- Main Control Unit (MCU).
- Electro Pneumatic Unit (EPU)
    - o I/S signal cable
    - o Starter box
- Skid assembly
- Pump/motor assembly
- Flowmeter system
- Sample probe valve assembly

2.2.1 Main Control Unit (MCU)

Reference drawings

- Dimensional drawing MCU Mark 6M **0806-1285**

The Main Control Unit is the central part of the Oilcon® Oil Discharge Monitoring and Control System and is designed for mounting in the cargo control console. Its function is to compute and record:

- The instantaneous rate of discharged oil, in litres per nautical mile
- The total quantity of oil discharged into the sea on each voyage
- To control the ships overboard discharge system
- The oil content

The Main Control Unit receives the following input signals to control the ship's overboard discharge system:

- Ship's GPS input
- Ship's speed in knots
- Overboard valve position
- Oil content of ballast water in ppm *
- Rate of discharge of ballast water in cubic metres per hour *

*Inputs marked * are received from the EPU via a serial data link.*

The MCU processes these inputs and records and displays all the necessary information.

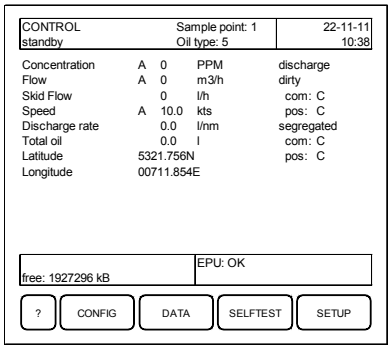


Figure 1

The data is displayed on the LCD touch screen and is also logged to an internal memory.
Control of the MCU is through the LCD touch screen.
The MCU also displays a number of menus with information about the system's status, configuration and settings. The various menus are designed to help the operator to control the Oilcon® Oil Discharge Monitoring and Control System and to give a wide range of information.

2.2.2 Electro Pneumatic Unit (EPU)

Reference drawings

- Dimensional drawing and parts list EPU 1-2 sample valves Mark 6M **0806-1287**

The Electro Pneumatic Unit (EPU) contains the control electronics and the solenoid valves to switch the pneumatic signals. It also contains the Zener barriers for the input signals from the flowmeter(s), skid flow meter and measurement cell. There is a single electronic card installed, and a power supply in the cover of the upper section of the cabinet.

The EPU is designed for mounting in the engine room opposite the Skid on the engine room/pump room bulkhead or in another suitable location.

2.2.2.1 Intrinsically safe signal cable

The engine room mounted EPU is connected to the pump room mounted detector cell located within the skid assembly via an intrinsically safe (I/S) signal cable. The cable carries the following signals from the skid:

- Oil content signals generated by the detector cell
- Flow rate of sample water through the skid
- LED feedback signal

2.2.2.2 Starter box

Reference drawings

- Dimensional drawing motor starter box Ballast Monitor Mark 6 **0806-1075**

The control of the sample pump motor is from the EPU via the starter box. This unit contains a relay to switch the 3-phase supply to the pump motor and a thermal trip to protect the pump motor. It also has a main switch to isolate the pump motor from the 3-phase supply in case of maintenance. Location for the starter box is the engine room in the proximity of the sample pump motor.

2.2.3 Skid assembly

Reference drawings

- Dimensional drawing and parts list ballast skid Mark 6M **0806-1288**

The skid assembly contains the necessary items to handle the sampled ballast water and to measure the oil content. In the skid assembly there is a pneumatically operated shuttle valve (5), and a window wash pump (1).

The shuttle valve (5) selects between fresh water, forward or backward flush and sample water.

Also contained within the skid assembly is the detector cell (6) which contains the electronic sensing system to determine oil content. On the left hand side of the skid assembly is the window wash pump (1). This is a pneumatically operated pump which provides a 1 to 10 pressure boost to the window flushing water. Also included in the skid assembly is a flow shuttle valve (5), which sets a back pressure on the sample pump and a magnetic flow sensor (3) to determine flow through the skid assembly.

The skid assembly is normally mounted in the pump room opposite the EPU on the engine room side of the bulkhead.

2.2.4 Pump/motor assembly

Reference drawings

- Dimensional drawing sample pump/motor Ballast Monitor Mark 6 **0806-1076**
- Assembly drawing sample pump Ballast Monitor Mark 6 **0806-1260**

The pump/motor assembly comprise a high shear vortex pump, a gas tight bulkhead seal and a motor. The pump provides a degree of sample water conditioning as the shearing effect tends to produce droplets of oil of roughly similar size. The pump has a mechanical seal to provide sealing on the shaft. This shaft fits directly on the motor shaft and is inter-connected by a lantern ring. The shaft passes through a bulkhead seal, which consists of a number of rubber lip seals which are oil lubricated to form a gas tight seal. The motor is directly bolted to the bulkhead seal. The motor is suitable for 380V or 440V at 50Hz or 60Hz, runs at 2850rpm or 3420rpm respectively and is constructed to IP55 and isolation Class F, IEC 34-1.

2.2.5 Flowmeter system

Reference drawings

- Installation flowmeter Ballast Monitor Mark 5/6 **0806-8016**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**

The flow of water through the orifice plate causes a pressure difference across the plate. This differential pressure is converted into a mA signal and transmitted to the EPU by the dP/I transmitter.

The manifold valve block fitted to the differential pressure transmitter, has three shut-off valves. The two outer valves are for blocking off the pressure sensing lines from the sensor. The centre valve serves as an equalizing valve to balance the pressure at both sides of the transmitter.
See drawing **0806-8038** (sheet 2 of 4) for configuration of the system.

2.2.6 Sample probe valve assembly

Reference drawings

- Dimensional drawing sample valve Mark 6 **0806-1077**
- Part list sampling probe pipe connection Ø15 mm Ballast Monitor Mark 6M **0806-1265**
- Part list isolating valve Ø15 Ballast Monitor Mark 6 **0806-1268**

For taking a representative sample of the ballast water to measure the oil level content, a sample probe valve assembly is provided. It comprises:

- a probe, for penetration in the selected discharge line;
- a gate valve, for manual closure upon completion of monitoring;
- a pneumatic valve, for remote selection of the discharge line, so the line can be changed whilst the monitor is in operation.

2.3 SAMPLING SYSTEM ARRANGEMENTS

Reference drawings

- Dimensional drawing and parts list ballast skid Mark 6M **0806-1288**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**

A suggested installation configuration of the Oilcon® Oil Discharge Monitoring and Control System is given in drawing **0806-8035**. Up to 6 sampling points can be catered for, although most ships will have much less than this. The total number of valves that are contained in the system is depending on the particular configuration on the ship.
The sample point is selected from the MCU in the ship's cargo control room (CCR). This causes the selected valve to open. When the system is in operation, water is drawn from the sample point by the sample pump, passed through the detector cell and then discharged to the slop tank or discharged overboard, depending on the installation.

The accuracy of the monitor is improved by the use of a flushing sequence before sampling commences, at intervals during sampling and when the system is shut down after use. All the flushing sequences are carried out automatically by the system.
The flushing sequence serves 3 purposes:

- to clean the pipework
- to keep the detector cell windows clean, which keeps the optical path un-obscured
- to perform a zero check every time a flush sequence is activated

The flushing sequences can be operated manually from the MCU, if required.

The skid assembly, see drawing **0806-1288**, contains a pneumatically operated shuttle valve, which facilitates the forward flush and backward flush. During the automatic flushing sequences on start up, and on shut down, the valve activates to flush all the pipework using the fresh water supply and sequentially selects between backward and forward flush. When the manual flush is operated, valves are activated to allow fresh water into the system and an additional zero check is performed.

During sampling every 3 minutes, an automatic cleaning of the windows in the detector cell is carried out. A pneumatic pump mounted in the skid assembly supplies high pressure fresh water which is sprayed across each window. It will be noticed that the window wash sequence is indicated on the MCU in the top left corner by "window wash".

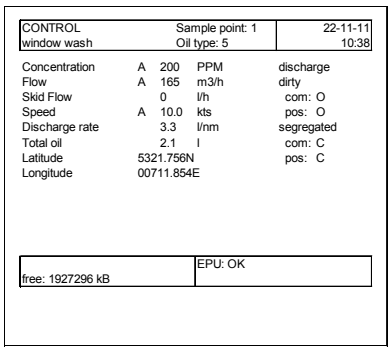


Figure 2

For correct operation of the system it is important, that during operations an un-interrupted supply of fresh water is available. The fresh water used must also be free of any contaminants or air bubbles.

The typical installation in drawing **0806-8038** shows a number of manual valves. These are used for isolation the system or maintenance purposes. The valves are:

- fresh water pressure reducing/isolator valve
- sample discharge valve skid
- isolation valve to slop tank *YARD SUPPLY* (usually a non-return valve, as the slop tank will most likely be pressurised due to an inert gas system)
- sample grab cock mounted on the sample pump discharge
- injection point (for onboard calibration by an approved service engineer)

NOTE:
There is an unmarked valve inside the skid assembly on the outlet side of the measurement cell. This valve is used to provide back pressure for the sample pump. If the valve is open fully, there will be little or no back pressure on the pump, possibly causing the pump to cavitate and resulting in erroneous reading of oil content.
The correct setting for the valve is almost closed. In this position the pump discharge will be in the region of 450–550 litres per hour. This skid-flow can be checked when sample-mode is entered, in the MCU menu 1.5.3.4.

3 TECHNICAL SPECIFICATION

3.1 GENERAL

Range	0 – 1000 ppm
Type of oils	In accordance with type approval certificate oils as per MEPC 108(49) and biofuel blends as per MEPC 240(65)
Accuracy	In accordance with IMO Resolution MEPC 108 (49), the system response is within the accuracy specified.
Response time	Less than 40 s, in accordance with IMO Resolution MEPC 108 (49)
Zero noise	Less than 2 ppm
Response to oils	In accordance with IMO Resolution MEPC 108 (49), the system response is within the accuracy specified.
Sensitivity to solids	In accordance with IMO Resolution MEPC 108 (49), the system response is within the accuracy specified.
Fouling	In accordance with IMO Resolution MEPC 108 (49)
Alarm adjustment	0 - 1000 ppm.
Sample points	2 standard, (optional 6 maximum)

3.2 MAIN CONTROL UNIT (MCU)

Electrical supply	24VDC – 0,1A
Emergency supply	24VDC – 0,1A (Source independent from source main supply)
Power consumption	2,4W
Ambient temperature	-20 °C – +55 ºC
Humidity range	0 – 95 % RH
Mounting	panel mounted, see drawing **0806-1285** for dimensions
Wiring 24V-supply (X8) (X9)	2 x 0,5 mm^2 cable
Wire size output-connectors	Min-max 0,2 – 2,5 mm^2
Wire size input-connectors	Min-max 0,2 – 2,5 mm^2
Installation category	II
Pollution degree	I acc. to IEC 664
Ventilation requirements	no special requirements
Communication (X13)	RS422/485 4-wire to EPU. Baud rate: 9600, Data bits: 8, Parity: none, Stop bits: 1, Flow control: None
<u>Input signals</u>	
Feedback Discharge-segregated-ballast (X10)	NC contact, rating 2,2 mA
Feedback Discharge-dirty/clean-ballast (X11)	NC contact, rating 2,2 mA
Ship's log (X12)	100, 200, or 400 p/NM, rating 5 mA
GPS (X14)	GPS NMEA 0183, RS485 2-wire, Baud rate: 4800, Data bits: 8, Parity: none, Stop bits: 1, Flow control: None MCU is reading following strings: • RMC, GLL and/or GGA for ships' position • VTG for ships' speed

Output signals

USB	USB Flash drive with a type A connector USB 1.0 compatible and formatted according to FAT16
Serial output	-
Alarm relay (X3)	NO/NC contact, rating 250 VAC – 5 A or 30 VDC – 5 A
Failure-24V relay (X4)	NO/NC contact, rating 250 VAC – 5 A or 30 VDC – 5 A
Auto/manual relay (X5)	NO/NC contact, rating 250 VAC – 5 A or 30 VDC – 5 A
Dirty/clean discharge valve (X6)	NO/NC contact, rating 250 VAC – 5 A or 30 VDC – 5 A
Segregated discharge valve (X7)	NO/NC contact, rating 250 VAC – 5 A or 30 VDC – 5 A

3.3 ELECTRO PNEUMATIC UNIT (EPU)

Electrical supply	115/230 VAC, 50/60 Hz
Power consumption	60 W
Air supply	4 – 7 bar, dry clean air (0,4 MPa – 0,7 MPa) average consumption 6 l/min max. consumption 50 l/min
Ambient temperature	-20 °C – +55 ºC
Humidity range	0 – 95 % RH
Protection class	IP 65
Mounting	wall mounting, see drawing **0806-1287** for dimensions

Output signals

Communication	RS422/485 to MCU
Pump start/stop signal	24 VDC, to sample pump starter relay
Pneumatic supply	4 bar to skid and sample valve

Cable glands	See drawing **0806-2050** for options
(1) Mains supply	M20 x 1,5 (cable diameter 6 – 12 mm)
(2) Communication to MCU	M20 x 1,5 (cable diameter 6 – 12 mm)
(3) Pump starter box	M20 x 1,5 (cable diameter 6 – 12 mm)
(4) Ballast skid	M20 x 1,5 (cable diameter 10 – 14 mm)
(5) Flowmeter dP/I	M20 x 1,5 (cable diameter 6 – 12 mm)
(6) Spare	M20 x 1,5 (cable diameter 6 – 12 mm)

Wire size supply-connectors	Min-max	0,2 – 2,5 mm^2
Wire size output-connectors	Min-max	0,2 – 2,5 mm^2
Wire size input-connectors	Min-max	0,5 – 4,0 mm^2
Installation category	II	
Pollution degree	II acc. To IEC 664	
Ventilation requirements	no special requirements	

3.4 SKID

Sample flowrate	between 450 and 550 l/h
Sample inlet pressure	3 bar (nom.), 6 bar (max.) (0.3 MPa nom., 0.6 MPa max.)
Fresh water supply	3 bar (nom.), 6 bar (max.) (0.3 MPa nom., 0.6 MPa max.) average consumption 0,13 l/min max. consumption 8 l/min
Water temperature range	10 °C – 65°C, in accordance with IMO Resolution MEPC 108 (49)
Ambient temperature	-20 °C – +55 ºC
Humidity range	0 – 95 % RH
Protection class	IP 65
Mounting	wall mounting, see drawing **0806-1288** for dimensions

Connections

Fresh water and sample water	15 mm tube coupling
Air to valves	6 mm tube coupling
Air to pneumatic pump	8 mm tube coupling
Cable to EPU	M20 x 1,5 (cable diameter 10 – 14 mm)
Wire size connectors	Min-max 0,2 – 2,5 mm^2

3.5 SAMPLE PUMP

Electrical supply	3-phase 380–420 VAC, 50Hz, 1.1 kW, 2.5 A or 3-phase 440–480 VAC, 60 Hz, 1.3 kW, 2.5 A
Power consumption	1300 W
Isolation class	F, IEC 34-1
Protection class	IP 55
Mounting	wall mounting, see drawing **0806-1076** for dimensions

Connections

Sample water	15 mm tube coupling
Cable	M20 x 1,5 (cable diameter 10 – 14 mm)
Wire size connectors	Min-max 0,2 – 2,5 mm^2

3.6 REFERENCE TABLE OF PRODUCTS WHICH MAY BE MEASURED

Crude oils, and "black" and "white" products (Annex I)

Range number	Product
0	Marine Distillate Fuel oil
1	Category 1 crude oil
2	Category 2 crude oil
3	Category 3 crude oil
4	Category 4 crude oil
5	Category 5 crude oil
6	Category 6 crude oil
7	Automotive Gasoline
8	Kerosine
9	Not used

Biofuel blends (Annex I) according Resolution MEPC.240(65)

Range number	Product
10	Biofuel blends of Diesel/gas oil and vegetable oil (25% vegetable oil, 75% Diesel/gas oil)
11	Biofuel blends of Diesel/gas oil and vegetable oil (1% vegetable oil, 99% Diesel/gas oil)
12	Biofuel blends of Diesel/gas oil and Alkanes C10-C26 linear and branched Flashpoint >60C (25% Alkanes, 75% Diesel/gas oil)
13	Biofuel blends of Diesel/gas oil and Alkanes C10-C26 linear and branched Flashpoint >60C (1% Alkanes, 99% Diesel/gas oil)
14	Biofuel blends of Diesel/gas oil and Alkanes C10-C26 linear and branched Flashpoint ≤60C (25% Alkanes, 75% Diesel/gas oil)
15	Biofuel blends of Diesel/gas oil and Alkanes C10-C26 linear and branched Flashpoint ≤60C (1% Alkanes, 99% Diesel/gas oil)
16	Biofuel blends of Gasoline and Ethyl alcohol (25% Ethyl alcohol, 75% Gasoline)
17	Biofuel blends of Gasoline and Ethyl alcohol (1% Ethyl alcohol, 99% Gasoline)
18	Biofuel blends of Diesel/gas oil and FAME (25% FAME, 75% Diesel/gas oil)
19	Biofuel blends of Diesel/gas oil and FAME (1% FAME, 99% Diesel/gas oil)
	Note: The aforementioned percentages (%) are by volume
20/29	Range number 20 till 29 are not used.
30	Orimulsion
31	Calibration VAF

3.7 BIOFUEL GUIDELINES AND DEFINITIONS

According MEPC.1/Circ.761 the following definitions are given.

Bio-fuels are ethyl alcohol, fatty acid methyl esters (FAME), vegetable oils (triglycerides) and alkanes (C10-C26), linear and branched with a flashpoint of either 60°C or less or more than 60°C, as identified in chapters 17 and 18 of the IBC Code or the MEPC.2/Circular/tripartite agreements. Following the distribution of these guidelines, further bio-fuels identified as falling under the scope of the guidelines, will be recorded in annex 11 of the MEPC.2/Circular which deals with bio-fuel/petroleum oil blends.

When containing 75% or more of petroleum oil, the bio-fuel blend is subject to Annex I of MARPOL.

When containing less than 75% of petroleum oil, the bio-fuel blend is subject to Annex II of MARPOL.

4 SAFETY INSTRUCTIONS

4.1 SAFETY PRECAUTIONS

All precautions have been taken to ensure, in so far as reasonable practical, that the equipment has been designed and constructed to be safe and without risk to health or the environment when properly used.
Provided that the recommendations contained in this manual are carefully adhered to, no circumstances are foreseen where the equipment will present a health or safety hazard.

To ensure the safety of personnel, equipment and the environment:

- Always follow the safety, installation, repair and maintenance recommendations in this manual.
- All personnel who installs, operates, repairs or maintains the equipment should read this manual completely and make themselves acquainted with the equipment before installing, operating, repairing or maintaining the equipment.
- Make sure that all safety requirements are met before installing, operating, repairing or maintaining the equipment.
- Always use personal protective means when necessary.
- Always use the adequate tools to perform the work.
- Make sure that all equipment is isolated from the electrical-, water and air supplies before installing, repairing or maintaining the equipment.
- Never assemble or disassemble electrical equipment or remove or install printed circuit boards with power switched ON.
- Always handle printed circuit boards with CMOS components according to the correct procedures for such components, to prevent any damage due to electrostatic discharges.
- Only use cleaning solvents in a well ventilated area. Avoid breathing fumes. Keep away from open fire. Do not use solvents on plastic components or parts.

5 UNPACKING

Let the equipment acclimatize inside the closed box for at least one hour at the location where the Oilcon® Oil Discharge Monitoring and Control System will be installed.
When the equipment is taken out of the box, please leave the special protection supplied with the equipment as long as possible in place to avoid any damage.
Disposal of the packaging material should be done according to local laws or regulations, or according to the rules that are applicable on the vessel.

Details of main components of the Oilcon® Oil Discharge Monitoring and Control System:

Main Control Unit (MCU)

Weight: 1.5 kg
Dimensions: 257 mm x 157 mm x 126 mm (W x H x D)

Figure 3: Main Control Unit

Electro Pneumatic Unit (EPU)

Weight: 9.5 kg
Dimensions: 500 mm x 263 mm x 114 mm (W x H x D)

Figure 4: Electro Pneumatic Unit

Motor Starter Box

Weight: 1 kg
Dimensions: 126 mm x 176 mm x 100 mm (W x H x D)

Figure 5: Starterbox

Electronic Differential Pressure Transmitter (DP/I)

Weight: 8 kg
Dimensions: 225 mm x 195 mm x 194 mm (W x H x D)

Figure 6: Electronic Differential Pressure Transmitter

Orifice Plate

Thickness:	6 mm
Material:	Stainless Steel
Diameter and bore:	Specific to each installation

Figure 7: Electronic Differential Pressure Transmitter and Orifice Plate

Skid Assembly

Weight:	20 kg
Dimensions:	500 mm x 420 mm x 177 mm (W x H x D)
Air Connections:	6 mm and 10 mm tube
Water connections:	15 mm OD tube

Figure 8: Skid Assembly

Sampling Pump

Weight:	30 kg
Length overall:	348 mm
Cut out diameter:	290 mm
Connections:	15 mm OD tube

Figure 9: Sampling Pump

Total weight of the complete system: 87 kg

6 INSTALLATION

6.1 INTRODUCTION

This specification sets out the requirements for the installation, operation and maintenance of an Oilcon® Oil Discharge Monitoring and Control System on board a typical tanker. It should be studied carefully before actually commencing any operation or work.

For the purpose of installation the system can be divided into 4 categories:

1. Pump room equipment and related deck ancillaries (hazardous area)
2. Bulkhead penetrations
3. Engine room equipment * (non-hazardous area)
4. Control room equipment ** (non-hazardous area)

The exact location of the separate elements within these categories will vary from ship to ship but the specific location of some units relative to others is important.
In addition to safety precautions which must always be strictly observed for work in hazardous spaces, installation undertaken at sea, with the ship underway, require additional precautions.

* It is recognised that for some vessels the pump room and engine room are not adjacent. If this is the case, it will be necessary to mount the electrical equipment in some other suitable non-hazardous space adjacent to the pump room.

** Again, some vessels may not have a cargo control room. If this is the case, some other convenient area must be identified, such as the navigation bridge, the engine room or the accommodation area.

CAUTION:
ANY COMPONENTS MOUNTED ON OPEN DECK OR IN AREAS LIKELY TO ENCOUNTER TEMPERATURE AT OR BELOW FREEZING SHOULD BE PROTECTED ACCORDINGLY AGAINST FREEZING.

6.2 UTILITIES

For operation of the Oilcon® Oil Discharge Monitoring and Control System the following utilities are required:

6.2.1 Fresh water supply

An uninterrupted supply of fresh water free of any contamination is important for a correct operation of the Oilcon® Oil Discharge Monitoring and Control System, as the freshwater is used to keep the pipework and the windows of the detection cell clean and to perform a Zero check prior to operation of the system.

Fresh water supply conditions	
Nominal inlet pressure	1,5 bar (0,15 MPa)
Maximum inlet pressure	6 bar (0,6 MPa)
Average consumption	0,13 l/min
Maximum consumption	8 l/min, during FLUSH
Water temperature range	10°C – 65°C

6.2.2 Air supply

For a trouble free and satisfactory operation of the pneumatic components in the Oilcon® Oil Discharge Monitoring and Control System a supply of clean, dry air at a constant pressure is essential.

Air supply conditions EPU	
Valve control	4,0 bar nom., 7 bar max. (0,4 MPa nom., 0,7 MPa max.)
Window wash pump	4,0 bar nom., 7 bar max. (0,4 MPa nom., 0,7 MPa max.)
Average consumption	6 l/min
Maximum consumption	50 l/min

6.2.3 Electrical supply

Electrical supply conditions	
Main Control Unit	24 VDC – 0,1 A
Emergency supply	24 VDC – 0,1 A
Electro Pneumatic Unit	115/230 VAC 50/60 Hz, 0,5 A
Sample pump motor	3 phase 380–420 VAC, 50 Hz, 1.1 kW, 2.5 A or 3 phase 440–480 VAC, 60 Hz, 1.3 kW, 2.5 A

NOTE:
AS REQUIRED BY REGULATIONS THE EMERGENY POWER SUPPLY HAS TO ORIGINATE FROM A SOURCE INDEPENDENT FROM THE SOURCE OF THE MAIN POWER SUPPLY.

6.3 PIPEWORK GENERAL

All pipework for water services should be of a suitable material and capable of withstanding working pressures of up to 16 bar. The pipework has been standardised at 15 mm O.D. with a minimum wall thickness of 1 mm. For example: ASTM B111-69 alloy 706 - or BS 378/2871 type CN 102-0.
Air signal pipework should be copper, and generally be 6 mm O.D. x 4 mm I.D.
The exception in this sizing is the air supply for the window wash pump mounted on the skid, and shown as V12. These lines are 8 mm O.D. x 6 mm I.D. (ASTM B75-68 alloy 122 - or BS 2871/1971 type C106-0).

Pipework must be clean and oil free prior to fitting and care must be taken to ensure all joints are leak tight. Failure to ensure this will adversely affect system function, particularly if air leakage is evident on pump suction lines. Ideally all joints should be made using brazed couplings. If piping is being installed during a sea passage then compression fittings may be used. These couplings should be of a salt water resistant material, and the use of stainless steel compression rings may be necessary if a non-flared tube end technique is used to make the joints. Mild steel couplings must not be used. Pipework must be adequately clipped and supported, and shall not impose any strain or force on equipment, e.g. pump or skid assembly. Pipework must also be protected in exposed situations. In those cases where the water discharge from the ballast skid is taken to a slop tank, if the ship has an inert gas system, a loop-seal arrangement must be fitted in the discharge line to prevent contamination being forced back down the line. Also measures must be taken to prevent the discharge from free-falling into the tank. This is usually achieved by diverting the flow against the bulkhead of the tank.

CAUTION:
BEFORE THE SYSTEM IS PUT INTO OPERATION OR TESTED ALL PIPEWORK MUST BE FLUSHED AND CLEARED FROM DIRT OR FOREIGN MATTER.

Reference drawings

- Dimensional drawing and parts list ballast skid Mark 6M **0806-1288**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**

6.3.1 Sample pump unit

The sample pump unit comprises a pump, bulkhead mounting flange with integral gastight shaft seal and a flange mounted motor. For this purpose a hole with a diameter of 290 mm is to be made in the bulkhead wall. The pump unit shall be fitted to the bulkhead utilising the welding ring as supplied with the pump. This ring shall be welded to the bulkhead wall.
For the location of this hole verify with the pump dimensional drawing that there will be no obstacles, and that the pump unit can be accessed for maintenance. Maintain sufficient free space around the motor for free air circulation to cool the motor.
If possible, the unit should be located below all proposed sampling points and as central to these locations as possible. Care should be taken to ensure that under all operational circumstances a zero or positive pressure is present at the suction side of the pump.
The joints of the suction line must be airtight, otherwise air leakage will occur causing reduced pumping and monitoring performance. If air leakage is considerable, the pump may fail to prime or pump at all.

It will be observed that a length restriction has been placed on the sample pipes (refer to section 6.7.4 pipe work response time calculation) for two reasons:

a. To ensure that the total response time of the system is less than 40 seconds, as required by legislation. In fact, since the instrument response time is less than 10.8 seconds and the sample velocity in the specified pipework is 0.9 m/s, there is some margin here.
b. To ensure that the sample pump is not faced with excessive negative suction pressure due to high pipe losses.

6.3.2 Installation of the sample pump

WARNING:
IN THE CASE OF AN INSTALLATION AT SEA, WHERE THE PUMP ROOM CONSTITUTES A HAZARDOUS AREA, PRECAUTIONS FOR HOT WORK AS LAID DOWN BY THE OWNER MUST BE STRICTLY OBSERVED.

At the selected location a hole with a diameter of 290 mm is to be made in the bulkhead wall. The installer should note that in some circumstance it may be necessary to construct a “top-hat” device, to artificially extend the pump room/engine room bulkhead around the pump/motor assembly while the hole is being cut and the mounting flange fitted.

Weld-on the welding ring; make sure that the bolt holes are in X-position. These holes are not to be in + - position!
The gasket shall be placed in between the pump main plate and the welded ring.
For easy installation do not fit the oil reservoir yet.

Before connecting the system piping to the pump, the unit is to be securely fastened to the bulkhead. Long or heavy piping sections shall not be supported from the pump but by separate supports.

ALIGNMENT: No inspection or corrections to pump/motor alignment are necessary.

Install the oil reservoir and top up the reservoir with the supplied oil.

WARNING:
THE OIL RESERVOIR SHALL ALWAYS BE SUFFICIENTLY FILLED WITH OIL, AS THE PROPER FUNCTIONING OF THE GAS SEAL LOCATED IN THE CENTRE OF THE PUMP MAIN PLATE RELIES ON THE PRESENCE OF OIL, FOR LUBRICATING, SEALING AND COOLING PURPOSES.

6.3.3 Electrical installation pump

Verify the power supply. This is to match the data as shown on the electric motor nameplate. Grounding is to be carried out utilizing the grounding bolt located inside the terminal box, before the motor is connected to the mains.

6.3.4 First start

CAUTION:
UNDER NO CIRCUMSTANCES SHOULD THE PUMP RUN WITHOUT LIQUID. THE PUMP HOUSING MUST FIRST BE FILLED WITH LIQUID, OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

6.3.4.1 Self priming

The pump will not function or prime until the casing is filled with liquid. Make sure any discharge valve is opened before starting, enabling air to be released. Running the pump with zero capacity will cause excessive system pressure; heat generated in the pump and may overload the electric motor. Make sure any system valve should be fully opened when the pump is being started or stopped.

6.3.4.2 Direction of rotation

This can be seen or checked from the motor side only. Make sure that all piping is installed, and the pump is filled with water. Switch-on the pump unit for a short moment only! Look at the motor fan and notice the direction in which the fan spins. This must be clockwise, when looking from the back cover of the motor. An arrow also indicates correct direction of rotation. If direction of rotation is wrong, interchange any of two line wires of the power cable in the terminal box.

Reference drawings:

- Dimensional drawing sample pump/motor Ballast Monitor Mark 6 **0806-1076**
- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**

6.3.5 Skid

The skid is normally located in the pump room and is mounted on the pump room/engine room bulkhead. The unit should be positioned above the sample pump, but should be kept below the level of the sampling probe points wherever possible. This is to ensure full pipework and provision of adequate suction pressure for the pump.
The skid is provided with four mounting points, drilled to accept 12 mm bolts.
A sample point should be fitted between the pump discharge and the skid to facilitate the taking of grab samples for analysis.

Reference drawings

- Dimensional drawing and parts list ballast skid Mark 6M **0806-1288**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**

6.3.6 Sampling probes

WARNING:
IN THE CASE OF AN INSTALLATION AT SEA SAFETY PRECAUTIONS MUST BE OBSERVED WHILE DRILLING OPERATIONS TAKE PLACE. IN THE CASE WHERE WELDING IS NOT PERMITTED A SADDLE CLAMP ARRANGEMENT CAN BE UTILISED. THIS TYPE OF PROBE ARRANGEMENT SHOULD ONLY BE VIEWED AS TEMPORARY AND ARRANGEMENTS SHOULD BE MADE TO WELD THE PROBE IN PLACE AT THE NEXT OPPORTUNITY.

Sample point(s) are supplied with the monitor, for location at the selected points on the relevant overboard discharge lines and contains the following:

- A pneumatic operated valve for selection of the sample point;
- A sample probe to take the sample from the discharge line.

Each probe is supplied with a hand valve and a compression fitting which can be welded to the pipeline. Positioning of the sample probe within the pipeline is most important. To prevent excessive quantities of air being drawn into the sample pump, the probe should ideally be mounted in a rising vertical pipe section. This will ensure that, provide water is being pumped, the main pipe is always filled. Where it is not possible to mount into a vertical pipe then a horizontal section may be used and the probe located as shown in drawing **0806-1265**. VAF Instruments recommend that whenever possible the sample probe should be installed on the upstream side of the orifice plate.
In any case the probe should be located upstream of any diverting line to the slop tank.

The important points to note are as follows:

- The probe enters from the bottomside of the pipe.
- The probe is mounted a small distance into the pipe. This ensures a representative sample and reduces the possibility of picking up “sludge” deposited in the pipe.
- The probe end is located in the lower section of the pipe, partly to increase the possibility of obtaining an air-free sample and partly to reduce the obstruction in the pipe.
- The sample valve is mounted in the correct orientation. (Air inlet port uppermost)
- The sample valve inlet and outlet ports are correctly mounted.

Reference drawings

- Dimensional drawing sample valve Mark 6 **0806-1077**
- Part list sampling probe pipe connection Ø15 mm Ballast Monitor Mark 6M **0806-1265**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**

6.3.7 Orifice plate

6.3.7.1 General information

The orifice plate is a square-edged, concentric bore type, manufactured in stainless steel. It is designed to be clamped between two flanges, within the PCD of the flange bolts. Working pressure is up to 24 bar and working temperature is up to 290°C. Width is 3 mm on this vessels line size. In such cases where a bevel is machined on the bore of the plate, the side with the bevel on should be facing downstream when installed.

6.3.7.2 Installation of flow sensor

The single most important consideration, when installing an orifice plate type flowmeter is the amount of straight pipe available on each side of the orifice plate. It is appreciated that long lengths of straight pipe are not common in the average pump room, but it is essential that the flow through the orifice plate is not turbulent. The only way to achieve this is, to have a long smooth approach to the orifice plate. The minimum recommended length of straight pipe upstream of the plate is 10 x pipe diameters and downstream of the plate, is 5 x pipe diameters. Within these distances there should be no bends or obstructions such as valves. The effect of reducing these distances is a considerable reduction of the accuracy of the flowmetering system.

The accuracy of the flowmeter is limited to ±10% and this is easily achieved at high flow rates. However, at low flow rates, an orifice plate type flowmeter rapidly becomes inaccurate such that the accuracy limit of ±10% is reached at about $1/10^{th}$ of the maximum flow. If the orifice plate is not installed with adequate lengths of straight pipe, the effect is a reduction of the effective measuring range of the flowmeter and a widely fluctuating signal.

The orifice plate should be mounted in such a position so as to ensure a full pipe at all times, which is usually best achieved in a vertical pipe. The pipeline downstream of the sensor must be arranged to ensure that no siphoning effect is possible. To prevent siphoning in horizontal installations, the discharge line must rise by at least 1 x pipe diameter above horizontal centre line. The rise should be so arranged that it is located at least 5 x pipe diameters after the orifice plate.
It must be stressed that if above installation requirements cannot be met, VAF Instruments should be consulted for advice. VAF Instruments cannot held be responsible for any flowmetering system installed incorrectly or without due consultation.

The orifice plate is installed between the flanges using jointing material of 1.5 mm thickness.
Two pressure tapping holes are required, one on each side of the orifice plate. For pipelines larger than 25 mm diameter, it is advisable to weld a threaded boss to the pipeline. For lines less than 25 mm diameter the pipe itself can be drilled and tapped. In both cases, the hole must be threaded for ¼" BSP. The boss upstream of the orifice plate must be sited 1 x pipe diameter from the centre-line of the plate. The boss downstream of the orifice plate must be sited ½ x pipe diameter from the centre line of the plate. In the case of a vertically rising line, the bosses can be sited at any position on the circumference of the pipe. In a horizontal line, the bosses must be sited on the horizontal centre line of the pipe.

Reference drawings

- Dimensional drawing ball valve flowmeter kit Ballast Monitor **0806-1041**
- Installation flowmeter Ballast Monitor Mark 5/6 **0806-8016**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**

6.3.8 dP/I transmitter

The electronic differential pressure transmitter is a two- wire transmitter which converts the differential pressure developed by the flow sensor into a 4–20mA signal.
Select a location for the transmitter that is close to the orifice plate, not exceeding 16m and where the ambient temperature will not exceed 90°C nor be less than -40°C. The location should be as free from vibration as possible.

The transmitter must be mounted so that the measuring element is vertical. A mounting bracket and U-bolt is supplied to mount the instrument on and is suitable for either pipe or surface mounting. For pipe mounting, the bracket accepts from 30 mm up to 60 mm diameter pipe and can be positioned on a horizontal or vertical pipe.
The differential pressure sensing lines from the flow sensor are coupled to the transmitter's 3-way manifold using ¼" NPT/10 mm couplings which are supplied.
The 3-way manifold contains isolating valves and an equalizing valve.
The pressure sensing lines must be routed with a minimum gradient of 1:10 fall after an initial fall from the pressure tapping points of 300 mm. The lines should be adequately clipped. Two isolating valves are supplied; one end threaded ¼" BSP for connection to the pipe.

The dP/I transmitters are certified as  II 1 G Ex ia IIC T4 or T5.

EXPLANATION OF EQUIPEMENT MARKINGS: "Ex" Equipment in compliance with European standards for potentially explosive atmospheres.

"ia" Equipment in compliance with specific building rules for intrinsically safe equipment.

"C" Equipment for use with gas of the subdivision C.

"T4" Equipment whose surface temperature does not exceed 135°C when used in an ambient temperature less than 80°C.

The equipment is suitable for areas classified as:

- Zone 0 (an area in which an explosive atmosphere is present continuously or during long periods);
- Zone 1 (an area in which an explosive atmosphere is likely to occur in normal operating conditions);
- Zone 2 (an area where an explosive atmosphere is not likely to occur in normal operation).

WARNING:
IN HAZARDOUS ZONES WITH EXPLOSION PROOF REQUIREMENTS THE COVERS MUST BE TIGHTENED WITH AT LEAST 7 TURNS. IN HAZARDOUS ZONES WITH INTRINSICALLY SAFE OR NON-INCENDIVE REQUIREMENTS, THE CIRCUIT ENTITY PARAMETERS AND APPLICABLE INSTALLATION PROCEDURES MUST BE OBSERVED.
CABLE ACCESS TO WIRING CONNECTIONS IS OBTAINED BY ONE OF THE TWO CABLE CONDUIT OUTLETS. CONDUIT THREADS SHOULD BE SEALED BY MEANS OF CODE APPROVED SEALING METHODS. THE UNUSED OUTLET CONNECTION SHOULD BE PLUGGED ACCORDINGLY. REFER TO SECTION 6.4.3 OF THIS MANUAL FOR FURTHER INFORMATION.

Reference drawings:

- Control drawing for Mark 6M Oil Discharge Monitor **0806-0005**
- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**
- Connection diagram dP/I Transmitter type FUJI / ABB **0810-2010**
- Dimensional drawing dP/I transmitter FUJI flowmeter kit Ballast Monitor Mark 5/6 **0899-1092**
- Dimensional drawing dP/I transmitter ABB flowmeter kit Ballast Monitor Mark 5/6 **0899-1163**

6.4 BULKHEAD PENETRATIONS GENERAL

Great attention has been paid, during the design of the Oilcon® Oil Discharge Monitoring and Control System to minimise the number of bulkhead penetrations which must be made and to make the total installation as simple and as straightforward as possible.
Nevertheless, two sets of penetrations which must be made.

6.4.1 Sample pump

The requirements for mounting this pump have been detailed in section 6.3.1 of this manual.

6.4.2 Air pipelines

The recommended method for making these penetrations is, using a proprietary transit system, for which approvals have been obtained such as the Multi Cable Transit system.
It is anticipated that the penetrations will usually be made with standard 6 mm and 10 mm pipe provided with a pipe connector at each side.

When the Oilcon® installation is required to be proven with oil injection, a commissioning engineer must make connections to the air supply line V11, on both sides of the bulkhead. The installers are therefore requested: To make at least the V11 bulkhead penetration using a 6 mm pipe connector, one on each side of the bulkhead penetration. Note that these components are outside VAF Instrument's normal scope of supply.

Reference drawings

- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**
- Multi cable transit Ballast Monitor Mark 6 **0806-8070**
- Parts list air supply units Ballast Monitor Mark 6 **0899-1258**

6.4.3 Intrinsically Safe signal cable

For general information, the Intrinsically Safe (I/S) signal cable between the EPU and the skid has a nominal 0,5 mm² diameter, 7 cores of 2 twisted pairs with an overall screen.
(EG Helkama RFE-HF60V)
The signal cable makes use of the same cable transit system as is used for the air pipelines to ease installation of the system.

BEFORE OPERATION:
It is vital to ensure that the equipment supplied exactly meets your needs and that it is certified for a safe use in your expected operating conditions. For the components such as the measurement cell and EPU items of equipment are certified. See section 16 for certification standards.

All circuits are connected to the energy limiting circuits within the EPU. These circuits limit the voltage by means redundant zener diodes, all connected to the same ground connection. The current is limited by means of resistors. Each circuit is thermally protected by means of a fuse.
The ratings of the circuits to the measurement cell is such that even in case of an total short circuit of all the circuits together, the energy within that short is still within non-ignitive intrinsically save energy levels (including a safety factor of 1.5) The additional position detection circuits are separated from the circuits to the measurement cell. The EPU contains two other energy limited circuits for connection to the approved dP/I sensors. These circuits are separated from the aforementioned circuits.

WIRING PROCEDURE:
Prior to initiating work on the wiring, be sure to turn OFF the main power.
Cables, cable glands and plugs certified in accordance with the considered zone must be used.
More, whatever the protection mode, only use plugs or cable glands with a protection degree of at least IP 65.

- Be sure that the cable diameter complies with the selected cable gland.
- Tighten the cable gland in accordance with supplier's instructions.
- Never forget to mount the covers and tighten then correctly.

REPLACEMENT PARTS:
The replacement of components can only be done by personnel trained to act on equipment intended for use in potentially explosive atmospheres. Spare parts must only be genuine parts supplied by VAF Instruments. During installation there is no need to operate the system and thus to switch the EPU on.

Reference drawings

- Control drawing for Mark 6M Oil Discharge Monitor **0806-0005**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**
- Multi cable transit Ballast Monitor Mark 6 **0806-8070**

6.5 ELECTRICAL INSTALLATION GENERAL

CAUTION:
ALL CABLES MUST BE OF SUITABLE TYPE FOR THE PURPOSE INTENDED.

All cables should be run on cable trays and should be secured to the tray by clips which will not damage the cable sheathing. Metal clips are not recommended, unless coated with a suitable buffer material such as nylon or PVC.
All screened cables should be run on a separate cable tray, if possible.
Under all circumstances screened cables must be kept segregated from AC power cables, at a minimum distance of 0,5m.

All cables passing through bulkheads should be led through an approved gastight bulkhead penetration/gland.
To avoid signal fouling due to electromagnetic induction, all braided copper screens on the screened cables should be connected at one end only, in the engine room. All exposed braids should be suitably trimmed and finished so that all braids end inside the cable gland, and no braids should enter into the cabinet.

NOTE:

- Make sure the temperature rating of the cables connected to the EPU should at least be 70ºC.
- The supply cables connected to the EPU should be secured in such a way that no connection can be made with the signal cables.
- For correct installation a suitable isolation switch shall be installed in the supply line as near as possible to the equipment. Maximum fuse current 16A.

Cable terminations for individual conductors should be finished with a pin terminal crimped on the conductor.
Cables are not supplied by VAF Instruments, unless specifically ordered.

6.5.1 Electro Pneumatic Unit (EPU)

NOTE:
All wiring connected to EPU from the hazardous zone must be connected in accordance with drawing **0806-0005** in order to ensure intrinsically safe circuits remain safe.

The EPU is of a sheet steel construction, it is mounted onto a steel frame which carries the pneumatic section of the assembly. It is normally situated in the engine room on the engine room/pump room bulkhead, opposite the skid mounted in the pump room.

This unit has both electrical and pneumatic connections, the electrical cables being run through the base of the cabinet to internal connectors. Suitable cable glands are provided for in the base of the cabinet.
The pneumatic connections are located in the right hand side of the cabinet mounting plate and are suitable for 6 mm O.D. and 10 mm O.D. pipe.
Mounting is by means of six holes drilled to accept 8 mm bolts.
Should the mounting side selected be subject to excessive vibration, anti-vibration pads or stiffeners should be installed to reduce these vibrations to an acceptable level.

6.5.2 Starter box

The starter box is used to switch and control the electrical supply to the sample pump motor and contains a relay and thermal relay to protect the pump for overheating. It may be mounted to any suitable location adjacent to the EPU or pump motor. The unit is mounted by four holes which accept 4 mm bolts.

Reference drawings

- Control drawing for Mark 6M Oil Discharge Monitor **0806-0005**
- Dimensional drawing motor starter box Ballast Monitor Mark 6 **0806-1075**
- Dimensional drawing and parts list EPU 1-2 sample valves Mark 6M **0806-1287**
- Connection diagram motor starter box Mark 6 **0806-2032**
- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**
- Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6 **0806-8035**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**

6.6 CONTROL ROOM EQUIPMENT – MAIN CONTROL UNIT (MCU)

This unit is normally mounted in the cargo control room and may be fitted into an appropriate space in one of the cargo control consoles, or wall mounted via a suitable wall mount box.
The Main control Unit is suitable for mounting into the console.

6.6.1 Speed input

1. The Main Control Unit is designed to accept a GPS NMEA 0183 input, baud rate: 4800, data bits: 8, parity: none, stop bits: 1.

   IMPORTANT:
   The latitude/longitude position command to be set with four (4) digits behind comma.

   The following NMEA0183 position messages can be accepted by the Main Control Unit:
   - RMC (Recommended Minimum Specific GNSS Data)
   - GLL (Geographic Position- Latitude/Longitude)
   - GGA (Global Position System Fix Data)

   The following NMEA0183 speed message can be accepted by the Main Control Unit:
   - VTG (Course over ground and ground speed)

2. The Main Control Unit is designed to accept a voltage free pulse signal from the ship's log or a similar device. Input pulses can be either 100, 200 or 400 pulses/NM.

6.6.2 Overboard valve control

The overboard valve is controlled by the MCU. To achieve this, the MCU is provided with a double pole switchover relay contact (discharge control relay) to control the discharge valve operation.
The valve feedback signal must be connected to the appropriate input terminal at the back of the MCU.
In case of system failure the Auto/Man relay contact can be used to override the MCU command, to switchover to manual operation. The relay contact is controlled by the key switch on front of the MCU.

Reference drawings

- Dimensional drawing MCU Mark 6M **0806-1285**
- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**

6.7 INSTALLATION CHECKLIST

6.7.1 General installation checks

1. Is all pipework of correct materials and dimensions?
2. Is all pipework adequately supported?
3. Does the maximum distance from furthest sample probe to the skid give a system response time of less than 40sec?
4. Is all pipework free from leaks?
5. Is the sample discharge line to the slop tank so arranged as to prevent free-fall into the tank?
6. Is the loop-seal (or non-return valve) of adequate height installed in the sample discharge line to the slop tank?
7. Is the sample pump installed in such a position as to have a positive pressure on the suction side of the pump at all times?
8. Is the relative position of the sample pump to the skid satisfactory?
9. Is the relative position of the skid to the EPU satisfactory?
10. Are the sample probes adequately supported and fitted with a manual stop valve as well as the pneumatic select valve?
11. Are the sample probes located in a vertical section of pipe with the flow upwards or in a horizontal section of pipe with the probe entering from the underside?
12. Are all discharges fitted with a sample probe?
13. Is the positioning of each sample probe at a location upstream of any recirculation line to the slop tank?
14. Is the sample probe inserted a distance of ¼ of the pipe diameter and is the probe correctly angled in the direction of the flow?
15. Is the capacity of the fresh water supply adequate?
16. Is the fresh water tank (if installed) made from non-corrosive material of adequate strength?
17. Is the fresh water tank (if installed) located a minimum of 6m above the skid?
18. Is the fresh water tank (if installed) fitted with an automatic filling valve of adequate size?
19. Are the EPU and the starter box mounted correctly?
20. Are all electrical cables supported adequately?
21. Are all signal cables segregated from AC power cables by at least 0.5m?
22. Are all cables terminated correctly?
23. Is the Main Control Unit mounted correctly?
24. Are all bulkhead penetrations gastight and of a type approved by the Administration?
25. If a starting interlock is required, has the method been approved by the classification society?

6.7.2 Check of Flowmeter and automatic control

1. Does the flowmeter orifice plate have the required minimum of 10x pipe diameter upstream and 5x pipe diameter downstream and has it been installed upstream of any recirculating line to the slop tank?
2. Is the orifice plate located in a vertical section of the pipe with an upwards flow?
3. If the orifice plate is located in a horizontal section of pipe, have measures been taken to ensure that the pipe will always be full of water, will not be subjected to siphoning and will ensure sufficient back-pressure across the orifice?
4. Is positioning of the orifice plate pressure tapping correct at 1x pipe diameter upstream and ½ x pipe diameter downstream of the orifice plate?
5. Do the pressure sensing lines from the orifice plate pressure tapping fall continuously to the differential pressure transmitter?
6. Is the automatic control of overboard discharge valve(s) and recirculation valve(s) installed correctly?
7. Are manual stop valves fitted as required?

6.7.3 Starting interlock and/or overboard valve control

IMO Resolution MEPC 108 (49) entitled:

“Guidelines and specifications for Oilcon® Oil Discharge Monitoring and Control Systems for tankers”

Oil tankers of 150 gross tonnage and above shall be fitted with an Oilcon® Oil Discharge Monitoring control system approved by the Administration and designed and installed in compliance with the Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers adopted by the Organization.

System should record and display the necessary information:

Input information:
Ship’s position (GPS)
Ship’s speed
Overboard discharge valve position
Oil content [ppm]
Flowrate discharge
Time and date
Starting interlock

Output information:
Time and date (UTC)
Ship’s position (GPS)
Auto/manual mode
Status of operational mode
Instantaneous oil content [ppm]
Flowrate of discharge [m³/h]
Ship’s speed [kts]
Instantaneous rate of discharge of oil [l/NM]
Total quantity of oil discharged [l]
Status of discharge
Sample point selected
Type of oil

The data is displayed on a LCD display and also stored in the internal memory

Due to the wide variety of starting interlock and overboard discharge control circuits VAF Instruments can only give a general concept of how they can be achieved.
Firstly: the IMO description of each version and then an interpretation of the system layout using the Oilcon® Oil Discharge Monitoring and Control System.

i) Discharge valve control

The definition of an overboard discharge control is given in paragraph 3.3 of the Annex to IMO Resolution MEPC 108 (49) and is as follows:

“An overboard discharge control is a device which automatically initiates the sequence to stop the overboard discharge of the effluent in alarm conditions and prevents the discharge throughout the period the alarm condition prevails. The device may be arranged to close the overboard valves or to stop the relevant pumps, as appropriate.”

ii) Starting interlock

The definition of a starting interlock is given in paragraph 3.4 of the Annex to IMO Resolution MEPC 108 (49) and is as follows:

“A starting interlock is a facility which prevents the initiation of the opening of the discharge valve or the operation of other equivalent arrangements before the monitoring system is fully operational when use of the monitoring system is required by the Convention.”

By its very nature Overboard Discharge Control can be considered a starting interlock, if the overboard valves are controlled from the Main Control Unit. They will only receive a signal to open for discharge when all the input parameters are correct.
If so connected as to stop the discharge by use of stopping the relevant pumps, this is not deemed a starting interlock. In this instance a starting interlock could be typically a valve spindle brake.

For an example of an overboard control circuit by use of interlocking overboard and slop tank return valves see drawing **0806-5019**. This also incorporates a starting interlock.

VAF Instruments advise that prior consultation is made with the classification society surveyor in each case to ensure that the arrangement will be acceptable both as to the operation and with regard to safety.

6.7.4 Pipework response time calculation

MARPOL regulations require that taking into consideration the length of sampling piping, the overall response time is as short as possible between an alteration in the mixture being pumped and the alteration in the meter reading and in any case not more than 40 seconds.
It is therefore, necessary to place a restriction on the length of the sample pipe from the probe to the detector cell. The system response time specific for this installation can be calculated as follows:

Monitor response time $T_1 = 10.8\ sec$

Total response time $T_{total} = 40\ \mathrm{sec}(max)$

Sample response time $T_2 = T_{total} - T_1$

$T_2 = 40 - 10.8 = 29.2\ sec$

The maximum length of sample pipe (in this example the sample pipe outside diameter 15 mm and thickness of the pipe 1 mm):

$$L_{max} = \frac{T_2 \cdot Q}{A \cdot 3600}$$

Where $T_2 = Sample\ response\ time$ [sec]
$Q = Sample\ flow\ rate\ [m^3/h]$
$A = Internal\ area\ of\ sample\ pipe\ [m^2]$

Internal surface area of the pipe

$D = 15\ mm = 0.015\ m$
$t = 1\ mm = 0.001\ m\ (wall\ thickness)$

$d = D - 2 \cdot t$
$d = 0.015 - 2 \cdot 0.001$
$d = 0.013\ m$

$A = \frac{\pi}{4} \cdot d^2$
$A = \frac{\pi}{4} \cdot 0.013^2$
$A = 1.33 \cdot 10^{-4}\ m^2$

Sample flow rate

$Q = 0.5\ m^3/h$

Therefore

$$L_{max} = \frac{T_2 \cdot Q}{A \cdot 3600}$$

$$L_{max} = \frac{29.2 \cdot 0.5}{1.33 \cdot 10^{-4} \cdot 3600}$$

$$L_{max} = 30.5\ m$$

6.7.5 Final check

Has completed system been inspected as a whole with regard to safety?

6.8 OVERVIEW INSTALLATION CHECK

6.8.1 Cable connection Main Control Unit

Reference drawings

- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**
- Connection diagram Oilcon Mark 6 Cable spec. MEPC 108(49) **0806-2050**

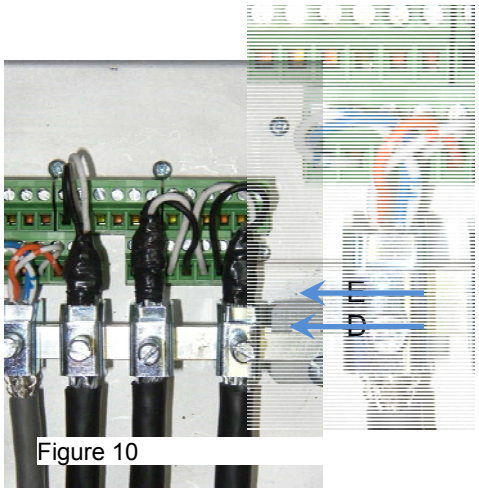


Figure 10

Figure 11

Screen and tension clamp (see Figure 10):

- The cable must be stripped up to point *D*
- The stripped cable must be inserted in the clamp
- The cable must by tightened by using screw *E*

Signal cable (see Figure 11)

6.8.2 Cable connection Electric Pneumatic Unit

Reference drawings

- Control drawing for Mark 6M Oil Discharge Monitor **0806-0005**
- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**

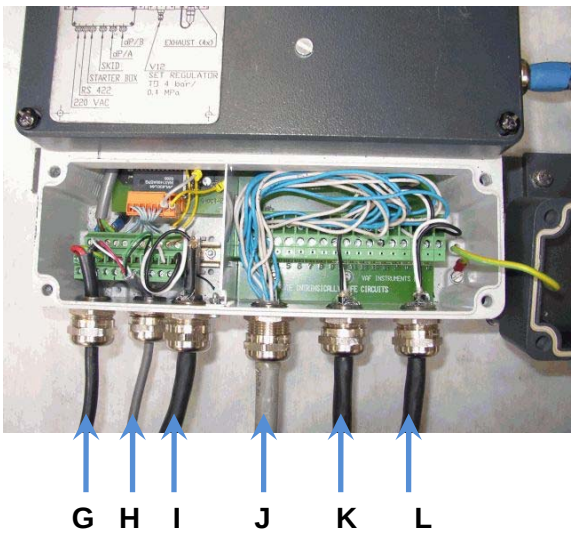


Figure 12

G	Power supply cable	IC-07
H	Signal cable	IC-03
I	Starter box sample pump cable	IC-06
J	Connection cable EPU ⇨Skid	IC-02
K	Overboard Flowmeter-1	IC-04
L	Overboard Flowmeter-2(if applicable)	IC-04

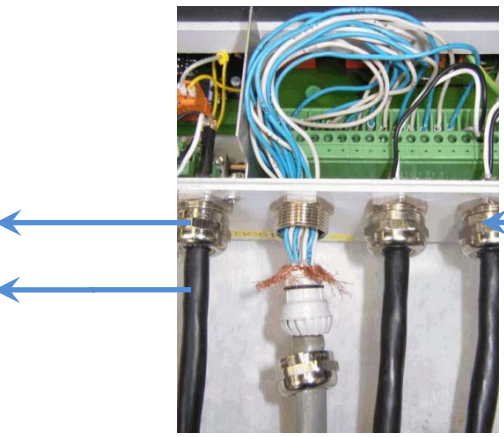


Figure 13

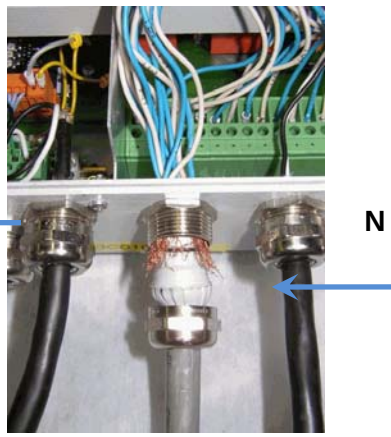


Figure 14

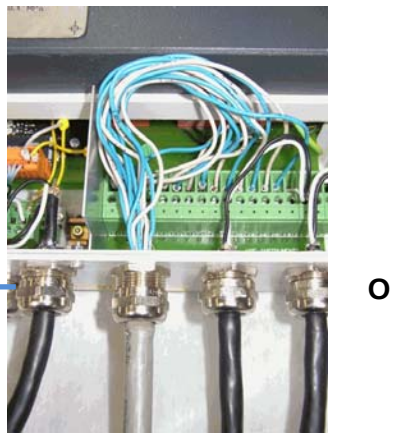


Figure 15

All cable connections to EPU and Connection Box Skid

- Strip the cable
- Guide the stripped cable through the synthetic insert ***M***
- Fold back the screen over the synthetic insert ***M***
- Push the synthetic insert ***M*** in the cable gland ***N***
- Tighten the gland nut ***O***

6.8.3 Intrinsically safe ground points, measurement cell and EPU

Reference drawings

- Control drawing for Mark 6M Oil Discharge Monitor **0806-0005**

Figure 16

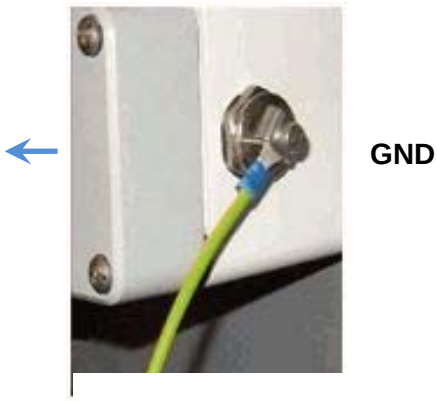


Figure 17

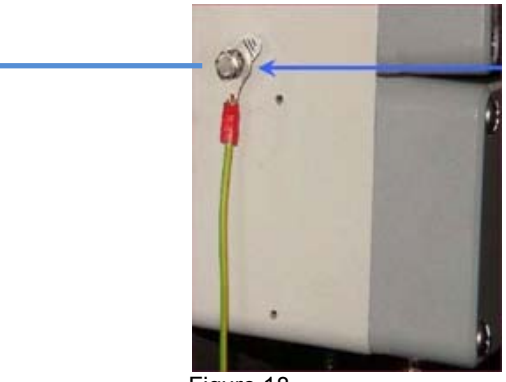


Figure 18

6.8.4 Power supply starter box and cable connection skid

Reference drawings

- Control drawing for Mark 6M Oil Discharge Monitor **0806-0005**
- Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49) **0806-2048**

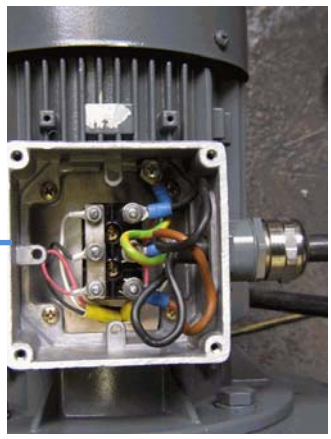


Figure 19

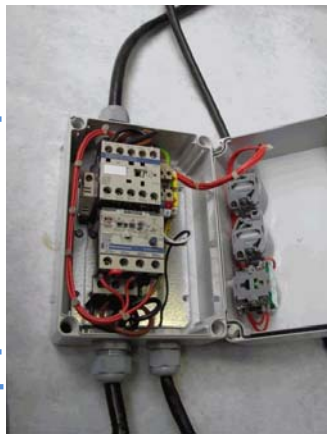


Figure 20

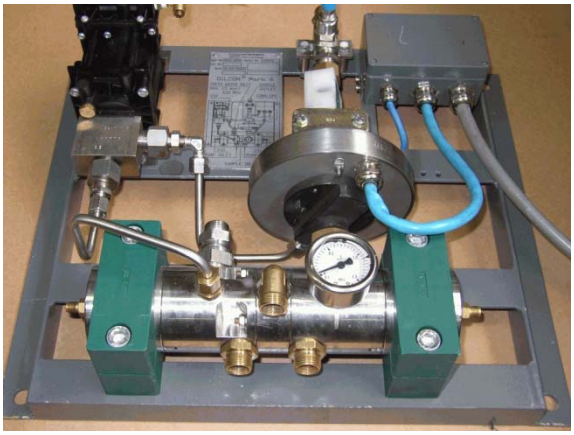


Figure 21

P. Power supply to starter box IC-08
Q. Power supply from sample pump to starter box IC-09
R. Power supply from starter box to sample pump IC-09
S. 24 V DC start signal IC-06 (see Figure 12 Item I)
T. Connection Cable EPU → Skid IC-02 (see Figure 12 Item J)
(Cable Item T must be installed according to section 6.5.1)

6.8.5 Multi Cable Transit (Bulkhead Penetration)

Reference drawings

- Multi cable transit Ballast Monitor Mark 6 **0806-8070**

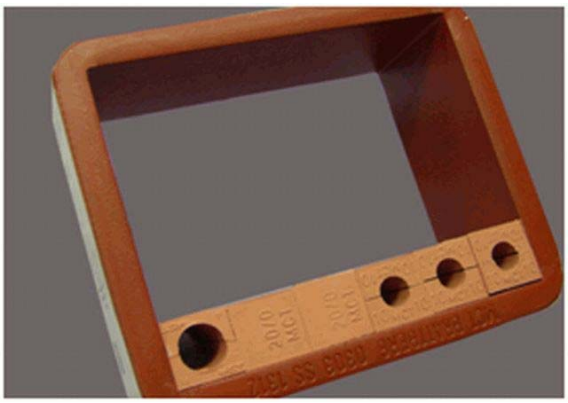


Figure 22

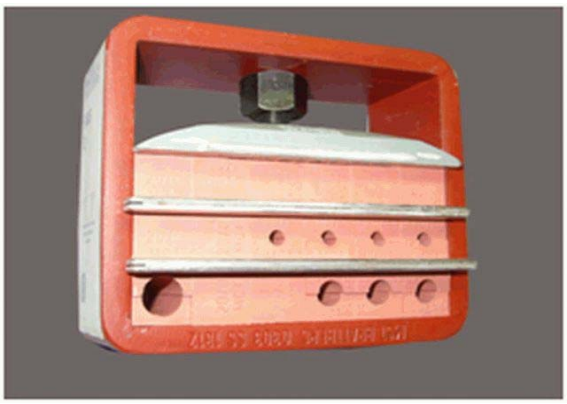


Figure 23

Figure 24

Installation of MCT

- Place insert-blocks ***U***
- Place cables and air pipes in accordance with size of the insert-blocks
- Place metal plates ***V***
- Place the next line of insert-blocks
- When all blocks and cables are installed, place item ***W***
- Tighten Nut ***X***
- Insert item ***Y*** and tighten nuts.

6.8.6 Water and Airline connections Skid

Reference drawings

- Dimensional drawing and parts list EPU 1-2 sample valves Mark 6M **0806-1287**
- Dimensional drawing and parts list ballast skid Mark 6M **0806-1288**
- Bulkhead penetration and piping diagram Mark 6M **0806-8038**

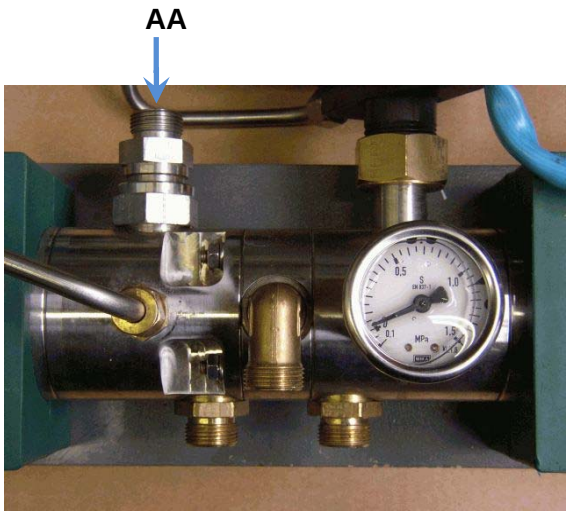


Figure 25

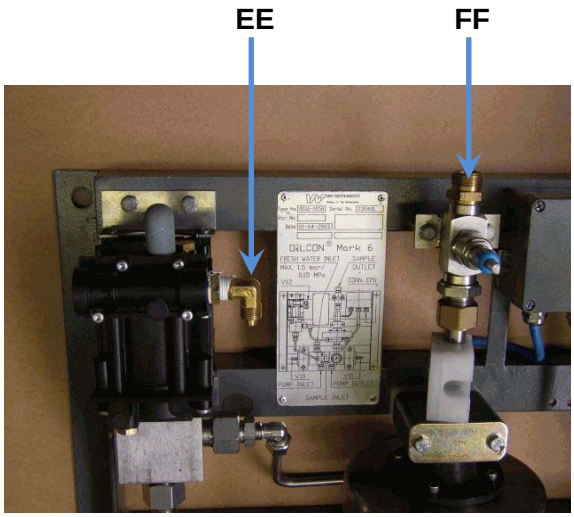
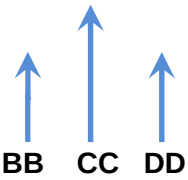


Figure 26



AA. Fresh water inlet
BB. To sample pump inlet
CC. Sample inlet from sample valve
DD. To sample pump outlet
EE. Airline from solenoid V12
FF. Sample outlet to slop tank
GG. Airline from solenoid V11
HH. Airline from solenoid V10

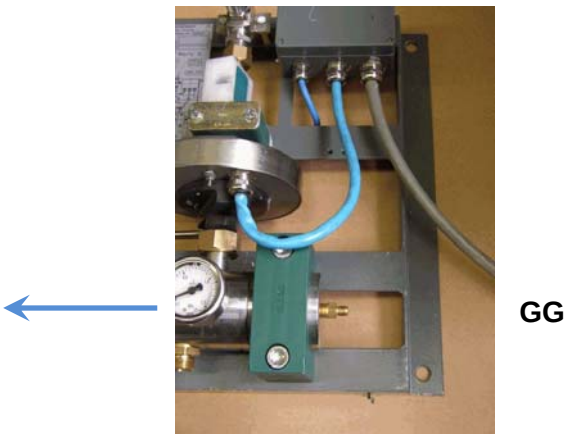


Figure 27

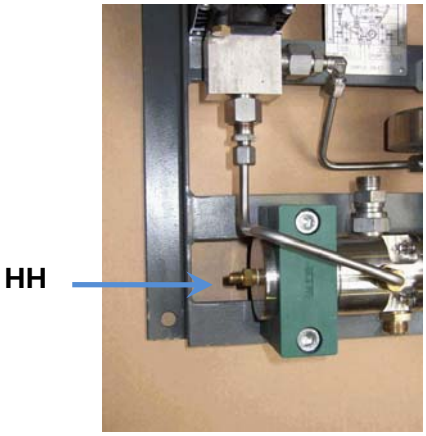


Figure 28

6.8.7 System settings.

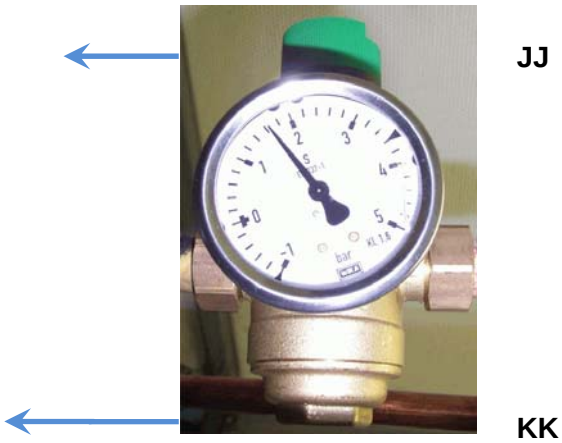


Figure 29

Figure 30

Fresh water regulator

JJ. Water pressure set knob, set pressure to 1,5 bar
KK. Fresh water filter

Air regulator

LL. Air pressure set knob, set pressure to 4 bar minimum

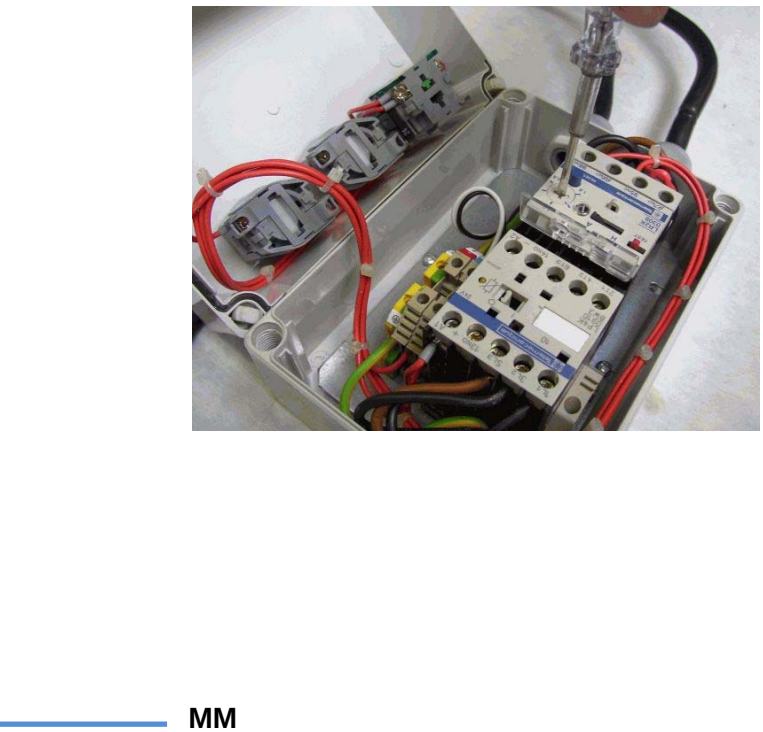


Figure 31

Starter Box

MM. Trip level setting

7 OPERATING INSTRUCTIONS

7.1 LAYOUT OF THE MCU

Operation of the Oilcon® Oil Discharge Monitoring and Control System is controlled and recorded by the MCU.
A representation of the control panel of the MCU, as fitted in the Cargo Control Room, is shown below.

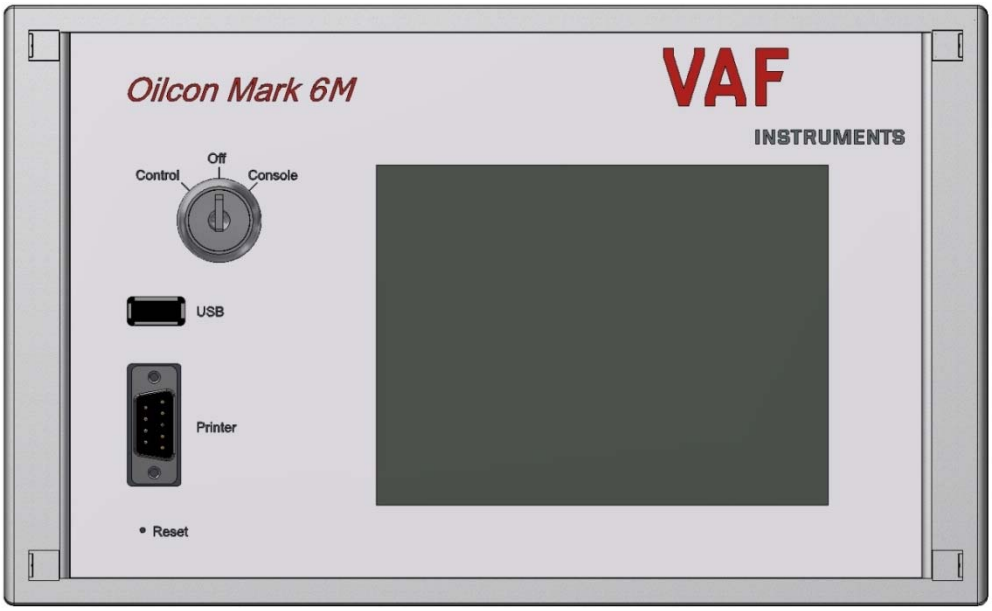


Figure 32: MCU layout

The MCU control panel contains the following:

- Control key switch
- USB connector
- RS-232 serial communication port
- Reset button
- Touch screen panel

7.1.1 Control key switch

The control key switch is used to put the MCU in the following modes:

- “Control” in this position the MCU is in the normal operational mode, automatically controlling the ballast discharge system if automatic control is fitted.
- “Off” in this position the display is blanked and the MCU goes to a quiescent state. Although the MCU is in a quiescent state some inputs are still monitored and logged in the internal memory.

NOTE:
Do not attempt to service the equipment in this mode, see section 8.

- “Console” in this position the MCU is in normal operational mode but manual control of the ballast discharge system is provided from the cargo console. There will be no alarms given and some inputs are still monitored and logged in the internal memory.

7.1.2 USB connector

A standard type A, USB connector is fitted to the MCU for copying logged data from the MCU to a USB flash drive.
Inside the MCU all operational data is stored in the internal memory. This data can be copied to a USB flash drive following the procedure as describe in section 7.2.1.3.

Per year and month a folder is created on the flash drive in which data files, containing the data per day, are copied.
The data is stored as plain text and can be opened by any text editor or word processing application on any computer for the purpose of viewing or printing.

7.1.3 Printer port

The print port can be used to connect a serial printer to the MCU.
The used printer must be compatible to the RS232 communication protocol. A printout of operational data can be made at regular intervals.
A printout of the data can be made following the procedure as describe in section 7.2.1.3.

A printer is not provided by VAF Instruments.

Since all data is saved in the internal memory of the MCU and can by copied to a USB flash drive there is no actual need for a printer. The printer port is only fitted to be used as an alternative to copying the data to a USB flash drive.

7.1.4 Reset button

In the rare case the MCU is unresponsive; the reset button can be pushed with e.g. a paperclip to forcibly reboot the MCU.
Previously stored data or setting will not be lost during a reboot.

7.1.5 Touch screen panel

The touch screen panel acts as the major interface between the MCU and the operator and displays all relevant information.
The touch screen is of the resistive type. In order to activate a key on the screen, a small amount of pressure has to be applied to the key by pressing it.

CAUTION:
IN ORDER NOT TO DAMAGE THE TOUCH SCREEN IT IS RECOMMENDED ONLY TO PRESS THE TOUCH SCREEN BY YOUR FINGERS AND NOT BY ANY SHARP OR POINTY OBJECT.

7.2 OPERATING THE MCU AND MENU LAYOUT

The MCU has a menu layout as show below.

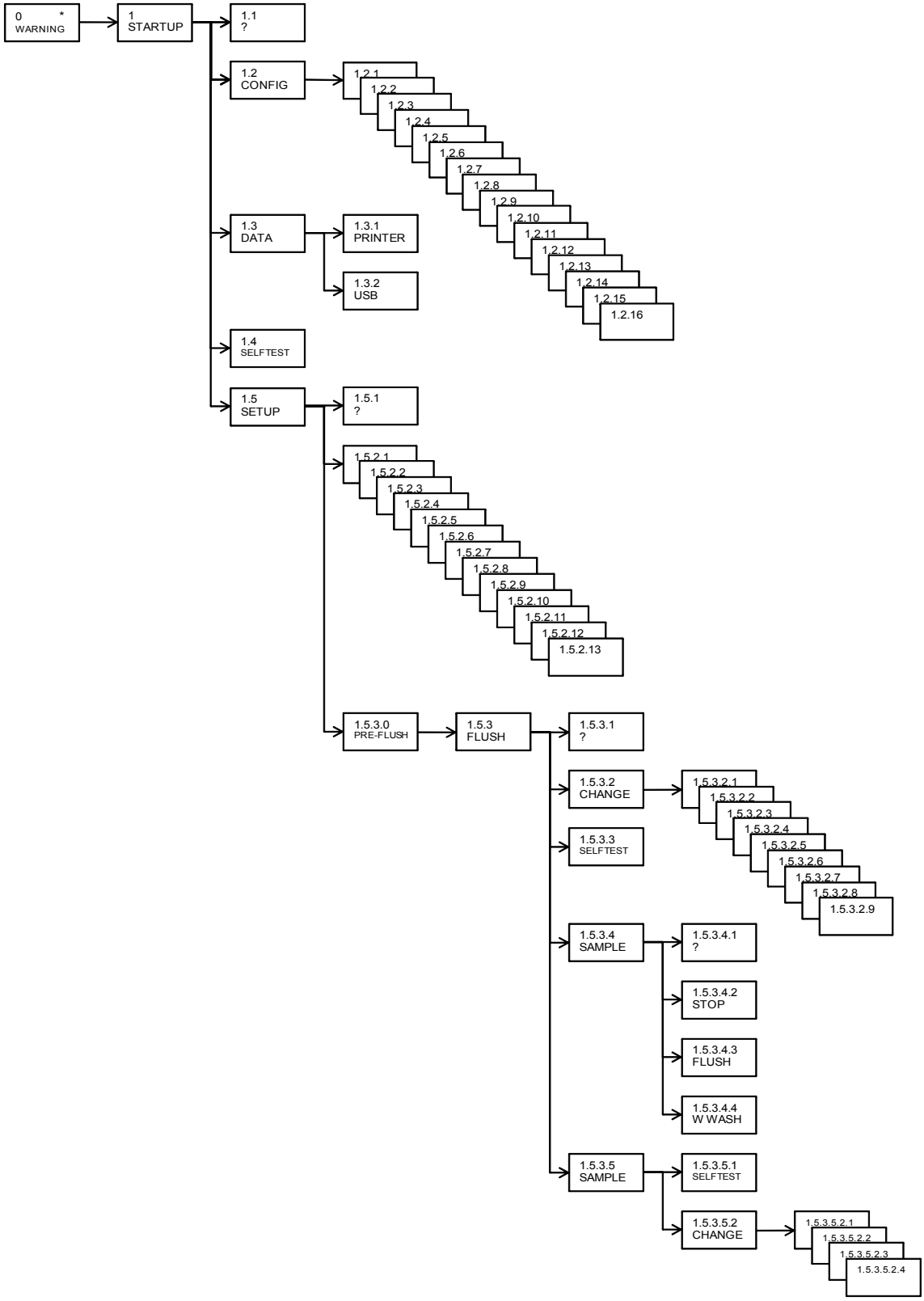


Figure 33: Menu flowchart

* The warning screen (menu 0) only appears if at start up of the MCU, the EPU is not powered on or the communication between the MCU and EPU is faulty.

In the different menus the following keys are available:

Navigation	
BACK	Previous menu
UP	Scroll up
DOWN	Scroll down
PRV	Previous screen
NXT	Next screen
+	Next setting
-	Previous setting

Operations	
SAMPLE	Start sampling operations
STOP	Stop sampling operations
FLUSH	Start flush sequence
W WASH	Start windows wash sequence

Menus	
?	Information screen
BUZZER	Buzzer test
CHANGE	Extended setup mode
CONFIG	Configuration menu
DATA	Data menu
PRINTER	Printer menu
SELFTEST	Self test menu
SETUP	Setup menu
USB	USB menu
MORE	Next screen

Action	
OK	Ok
CLR	Clear
A	Automatic
ACK	Acknowledge

With these keys it is possible to navigate through the different menus and change settings.
In the following sections, with a step by step walkthrough, is explained how to configure the MCU and how menus are to be used.

In the top left corner of the display, the current mode is displayed.

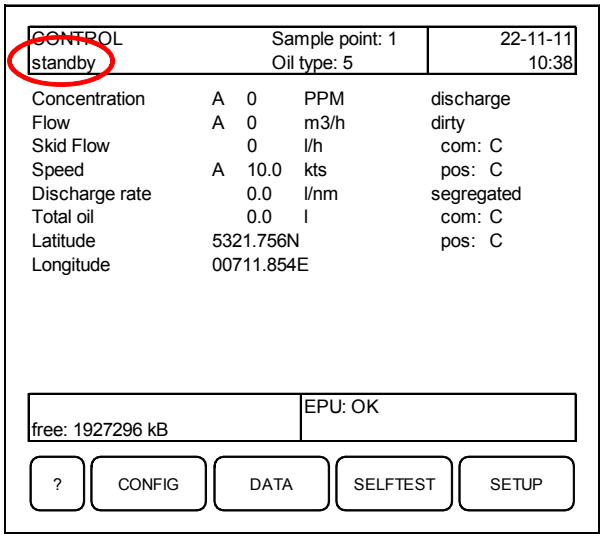


Figure 34

7.2.1 Standby mode (menu 1)

When the MCU and EPU are both powered on and the key switch is turned to the “Control” position, the MCU goes into the standby mode in **menu 1**.

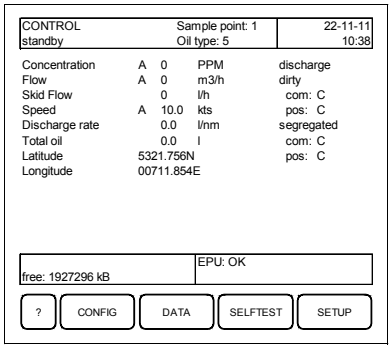


Figure 35: Menu 1

The standby mode is also automatically entered after performing the shutdown sequence. In standby mode the system is awaiting manual input from the operator.
By pressing the associated keys the following modes can be entered:

- ? Information mode (**menu 1.1**)
- CONFIG Configuration mode (**menu 1.2**)
- DATA Data mode (**menu 1.3**)
- SELFTEST Self test mode (**menu 1.4**)
- SETUP Setup mode (**menu 1.5**)

By turning the key switch to “OFF” all operations will be stopped.

If the MCU is powered on and the EPU is NOT powered on or the communication between the MCU and EPU is faulty, the MCU starts up with a warning screen (**Menu 0**).

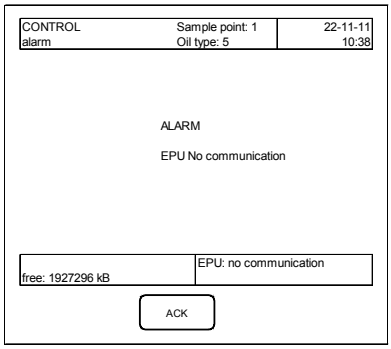


Figure 36: Menu 0

After the ACK key is pressed the start up screen is displayed, with the warning that there is no EPU communication.
Before the EPU is powered on or communications are restored, no operations are possible.

If a GPS signal is present, the current GPS coordinates are shown. Also will the GPS signal set the current date and time.

7.2.1.1 Information mode (menu 1.1)

The information mode is entered when the < ? > key is pressed in **menu 1**.
The mode gives additional information about system operation and operational actions which can be taken if e.g. an alarm situation occurs.
Depending from which menu the information mode is activated, different texts will be displayed.
In case the text is too long to be display all at once, it is possible to scroll through the test with the <UP> and <DOWN> keys.

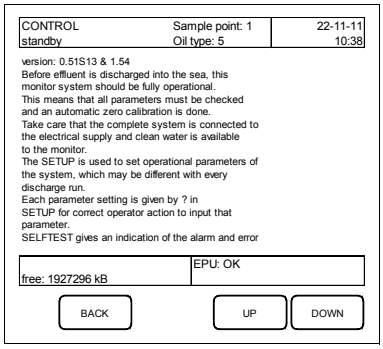


Figure 37

In menu 1.1 a short description about the use of the MCU is given:

Before effluent is discharged into the sea, this monitor system should be fully operational.
This means that all parameters must be checked and an automatic zero calibration is done.
Take care that the complete system is connected to the electrical supply and clean water is available to the monitor. The SETUP is used to set operational parameters of the system, which may be different with every discharge run.
Each parameter setting information is given by ? in SETUP for correct operator action to input that parameter. SELFTEST gives an indication of the alarm and error status of the system.
The function of the BUZZER can be checked by SELFTEST.

Flush mode
This Flush mode is used to check the condition of the detector cell and to calibrate the monitoring system.
The total flush time is 4-5 minutes.
The flush time is indicated in the display. Care should be taken that clean water supplied to the system is free from any contamination.

Idle
In the Idle mode the system is ready for sampling and is waiting for a command.
The commands in Idle mode are:
Selection of (extra) SETUP by CHANGE
Selection of SELFTEST
Start Sampling by SAMPLE.

Sample
In the sample mode the system is monitoring the discharge ballast water from the selected sample point.
During sample a 9 second automatic window wash takes place every 3 minutes, indicated by window wash.
Other commands in Sample are:
Stop operation by STOP.
Calibration of the system by FLUSH
Manual window wash by WINDOW WASH
Selection of SELFTEST
Selection of (extra) SETUP by CHANGE

7.2.1.2 Configuration mode (menu 1.2)

The configuration mode is entered when the <CONFIG> key is pressed in the **menu 1**.
The mode is used to set up the system during installation and this should only be done by a trained service engineer.

Prior to entering the settings, the operator must familiarise themselves with the system and also the following information. The majority of this information can be located on the vessel's IOPP certificate:

- Max range of flowmeter (if fitted)
- Pulses per nautical mile, ship's speed log input (if fitted), ship's GPS
- Ship's deadweight
- Status of the ship
- How many sampling points are fitted on the vessel and the denomination of each

In order to configure the system to the ship's specific requirements it is necessary to enter specific parameter setting.

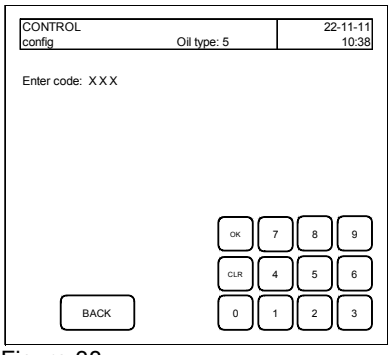


Figure 38

To enter the parameter setting

- The system has to be in the standby mode
- Press the <CONFIG> key to enter the setup mode (**Menu 1.2**)
- Enter password: 729

In the configuration mode the settings can be changed by either entering a numeric value or by selecting a preset value. Different preset values can be selected by pressing < + > or < - >.
Selecting a different setting is done by pressing the <PRV> or <NXT> key and thereby scrolling through the different settings.

*For example, by entering a numeric value with the < 0...9 > keys the setting for the maximum flow of Flowmeter 1 at 20 mA (**menu 1.2.1**) can be entered.*

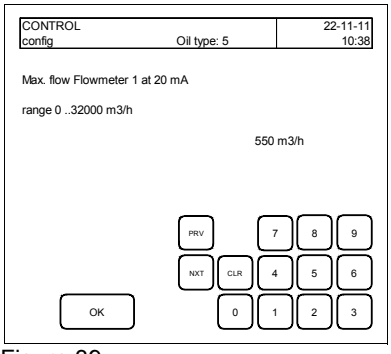


Figure 39

By pressing the <CLR> key the value is cleared after which the setting can be entered.

When the <PRV> or <NXT> key is pressed, the previous or next setting is selected and value entered in the current menu is automatically stored.
The following settings in the configuration menu (**menu 1.2.1 up to menu 1.2.16**) can be set:

Menu	Description	Range	Remark
1.2.1	Max. flow Flowmeter-1 at 20 mA	0...32,000 m3/h	The value to be entered is the maximum flow of the overboard discharge flow connected to the Oil discharge monitoring and control system, if fitted.
1.2.2	Max. flow Flowmeter-2 at 20 mA	0...32,000 m3/h	The value to be entered is the maximum flow of the overboard discharge flow connected to the Oil discharge monitoring and control system, if fitted. *In case of flowmeter-1 only, this setting must be set 0.*
1.2.3	K-factor skid flow meter	0…10,000 pulse/l	THIS FACTOR MAY NOT BE CHANGED This is the k-factor of the flow meter (flow sensor) installed in the skid. This factor is normally factory set and is mentioned on tag plate of flow meter (flow sensor).
1.2.4	Flow Configuration	Separated / Combined	This function makes it possible to COMBINE TWO FLOW METERS, IF FITTED BOTH. The system will choose the correct flow metering system based on current flow rate. The combined system option is only valid with older EPU versions See drawing **0806-8038** for configuration of the separated system.
1.2.5	K-factor measuring cell 0	0…10,000	THIS FACTOR MAY NOT BE CHANGED This is the k-factor of the measurement cell installed in the skid. This factor is normally factory set and is mentioned on tag plate of cell.
1.2.6	Ship speed	GPS / Ship's log	The value entered determines whether the input of the GPS or the ship's log is used to calculate the ship's speed.
1.2.7	K-factor Ships log	0…400 pulse/NM	The value entered is the input in pulses/nautical mile from the vessel's speed log (if installed).
1.2.8	Total ship's volume	0…600 kTon	The Value to be entered is the ships deadweight in kilo tons. In other words if the deadweight is 45,000 tons, a value of 45 must be entered
1.2.9	Status of the ship	New / Old	Value to be entered is either New or Old based on IOPP certificate Item 1.7
1.2.10	Number of sample points	1…6	The value to be entered is based on the number of sampling points installed on the ship.
1.2.11 ... 1.2.16	Name of sample point	- port high - starboard high - port low - starboard low - stripping - segregated ballast	The value to be entered is based on the name or nomination of each particular sample point. The sample points: - port high - starboard high - port low - starboard low - stripping are used for dirty/clean ballast (Relay X6) The sample point: - segregated is used for segregated ballast (Relay X7)

7.2.1.3 Data mode (menu 1.3)

The data mode is entered when the <DATA> key is pressed in the **menu 1**.
The mode is used to print out logged data with a printer or copy this data to a USB flash drive.
In the data mode a selection has to be made whether the data is printed to a printer or copied to a USB flash drive.

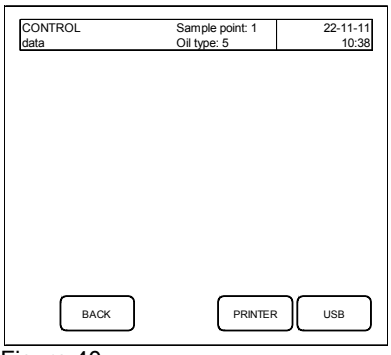


Figure 40

When a selection has been made, two dates in either **menu 1.3.1** or **menu 1.3.2** have to be set to mark the begin date and end date of the logged data to be printed or copied.
The data format used is DD – mm – YYYY.

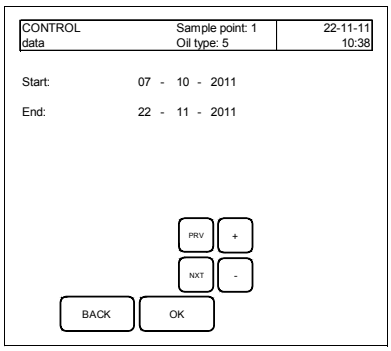


Figure 41

During the printing or copying no keys are available on the display. When the printing or copying has finished, the keys will reappear.

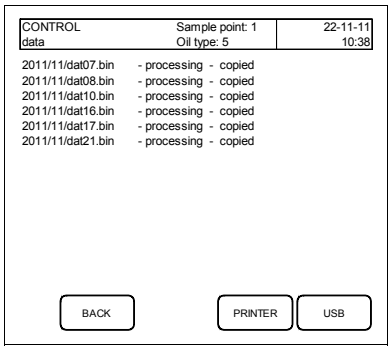


Figure 42

The MCU logs data at the following intervals:

- at the start and at the end of the discharge operation;
- at ten minutes intervals (or less, if set by the operator);
- at the occurrence of any alarm;
- if automatic or manual mode is selected;
- any fault of out of range inputs from the transducers;
- if any of the system settings is changed;
- if the front panel key-switch is operated;
- if the discharge rate changes by more than 10 l/NM;
- if an alarm situation is cleared.

Each time data is logged an appropriate message is printed at the top to explain why the data has been logged. The following messages can occur:

TIME INTERVAL REPORT
CONSOLE MODE REPORT
MANUAL DATA ENTERED
DISCHARGE VALVE OPEN
DISCHARGE PROHIBITED
DISCHARGE RATE INCREASING
CONTROL MODE REPORT
MANUAL TO AUTO CHANGE
OIL TYPE CHANGE
DISCHARGE VALVE CLOSED

NOTE:
According to the Regulations a printed record of the entire ballast water discharge operation must be kept on board the vessel for at least 3 years.

7.2.1.4 Selftest mode (menu 1.4)
The selftest mode is entered when the <SELFTEST> key is pressed in **menu 1**.
In the self test mode an overview is displayed of all alarms since the MCU is last powered down.

When the GPS input signal is disconnected and a wire link is connected to the GPS socket an internal test is carried out during the selftest. For further reference see section GPS problems 15.5

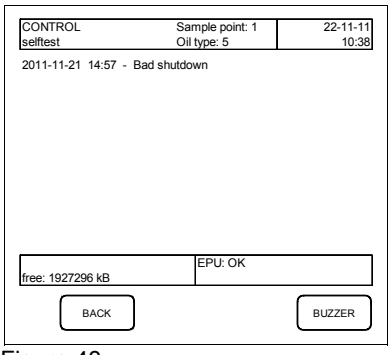


Figure 43

There is also a <BUZZER> key to test the internal buzzer. When the key is pressed the buzzer will sound for approximately 2,5 seconds.

7.2.1.5 Setup mode (menu 1.5)

The setup mode is entered when the <SETUP> key is pressed in the **menu 1**.
The mode is used to setup the system for a specific discharge operation.
When the setup menu is entered, 3 options are available:

- ? information mode (**menu 1.5.1**)
- CHANGE setup mode (**menu 1.5.2**)
- FLUSH calibration flush mode (**menu 1.5.3**)

When the < ? > key is pressed, the information mode is entered.
When the <CHANGE> key is pressed, the setup menu allows the operator to change specific parameters.
By pressing the <FLUSH> key the system is set up for sampling and discharging ballast water. Before the MCU goes into sampling mode, the system is flushed and calibrated.

7.2.1.5.1 Information mode (menu 1.5.1)

The information mode is entered when the < ? > key is pressed in **menu 1.5**.
The mode gives additional information about system operation and operational actions which can be taken if e.g. an alarm situation occurs.
Depending from which menu the information mode is activated, different texts will be displayed.

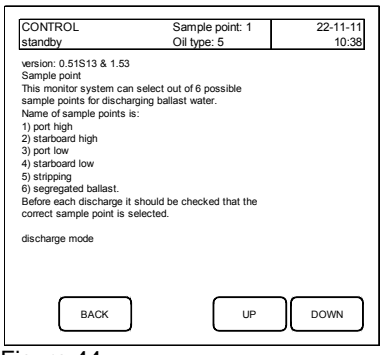


Figure 44

In **menu 1.5.1** a text with short description about the possible sampling points is given:

Sample point
This monitor system can select out of 6 possible sample points for discharging ballast water.
The names of the sample points are:

1) port high
2) starboard high
3) port low
4) starboard low
5) stripping
6) segregated ballast.

Before each discharge it should be checked that the correct sample point is selected.

Discharge mode
The discharge mode “dirty ballast” or “clean ballast” can be selected by the following sample points:

1) port high
2) starboard high
3) port low
4) starboard low
5) stripping

Total oil limit
According to the regulations the maximum “total oil limit” should never exceed:
1/30.000 of the last cargo by a new ship
1/15.000 of the last cargo by an old ship

Reset total oil
Accoring to the regulations only at the start of each new ballast voyage it is allowed to reset the total oil amount.
It is not allowed to set the total oil amount to zero once the discharge of ballast water has started.

Discharge alarm
According to the regulations the maximum allowed “discharge alarm” is 30 liters of oil per nautical mile. (30 l/nm).
Only a value of 30 l/nm or a lower value can be entered if required.

Speed log
The “Speed indication” input to this system can be either automatic or manual.
The automatic ship speed can be selected by pushing the – button until the automatic mode is reached. A manual ship speed can be selected by pushing the + button.
The selected input automatic/manual is indicated in the display by A or M behind the speed indication.

Flow rate ind.
The “Flow rate indication” input to this system can be either automatic or manual. The selection is made in this SETUP menu.
The manual selection is made by entering of a value.
The selected input automatic/manual is indicated in the display by A or M behind the flow rate indication.

Oil type
This monitor system is capable of detecting several different oil types.
Selection can be made out of 31 types.
It is necessary to check and/or select the correct oil type before each discharge run.

Conc. Alarm
According to the regulations an alarm should be given if the maximum measuring range of the system is reached of passed.
The “Concentration alarm” is set to the maximum range of this system. However a lower value may be entered. After “Clean ballast discharge” mode or “Segregated ballast discharge” mode is selected, the concentration alarm has to be changed manually when a “Dirty ballast discharge” selection is made.

Print recording int.
According to the regulations the maximum allowed “Print recording interval” is 10 min.
If required, interval times shorter than 10 min. are accepted as input by the system.
The default print recording interval is 5 min.

Oil conc. Ind.
The “Oil concentration indication” input to this system can be either automatic or manual. The selection is made in this SETUP menu. The manual selection is made by entering of a value.
The selected input automatic/manual is indicated in the display by A or M behind “Concentration”.

Display contrast
The “Display contrast” can be selected from 710 up to 790. The default setting is 750.

Date/Time
This system has an internal real time clock.
The date and time changes automatically when a GPS is connected.
The format of display is day/month/year hour/minute.
Example: 05/04/2011 is 5th of April 2011.

7.2.1.5.2 Setup mode (menu 1.5.2)

The setup mode is entered when the <CHANGE> key is pressed in the menu 1.5.2. In order to setup the system for a specific ballast water discharge, it is necessary to enter specific parameter settings.

In the setup mode the settings can be changed by either entering a numeric value or by selecting a preset value. Different preset values can be selected by pressing < + > or < - >.
Selecting a different setting is done by pressing the <PRV> or <NXT> key and thereby scrolling through the different settings.

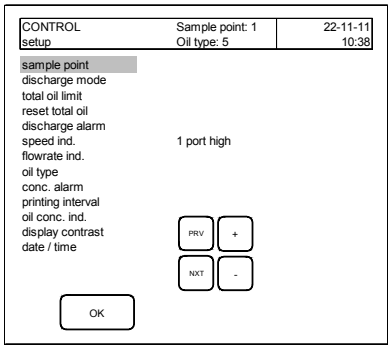


Figure 45

By pressing the <CLR> key the value is cleared after which the setting can be entered.
When the <PRV> or <NXT> key is pressed, the previous or next setting is selected and value entered in the current menu is automatically stored.

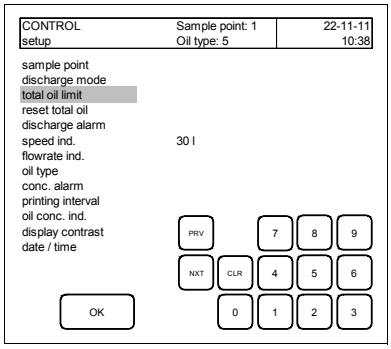


Figure 46

The following settings in the setup menu (**menu 1.5.2.1 up to menu 1.5.2.13**) can be set:

Menu	Description	Range	Remark
1.5.2.1	Sample point	1…6	The value to be entered is the number of the sample point from which a sample is taken.
1.5.2.2	Discharge mode	clean ballast / dirty ballast	The value entered sets the mode in which the MCU operates. In dirty ballast mode the ship's speed and overboard discharge flow input parameters are computed and the oil concentration is calculated. In clean ballast mode the ship's speed and overboard discharge flow input parameters are not computed and only the oil content is registered. The maximum oil content permissible in this mode is 15ppm*.
1.5.2.3	Total oil limit	0…40,000 l	The value to be entered is the maximum quantity to be discharged, not exceeding: - 1/30,000 of the last cargo carried (new ships) - 1/15,000 of the last cargo carried (existing ships)
1.5.2.4	Reset total oil	Yes / No	Resets the amount of oil already discharged. It is only permissible to reset the total oil discharged at the start of a new ballast voyage.
1.5.2.5	Discharge alarm	0…30 l/NM	The value to be entered is the maximum quantity to be discharged per nautical mile (normally 30 l/nm).
1.5.2.6	Speed indication	automatic / 0…40 knots	Speed indication can be Automatic(A) or Manual(M). Automatic can be selected by pushing the - button. Manual can be selected by pushing the + button.
1.5.2.7	Flowrate indication	automatic / 0…32,000 m³/h	Flow rate can be Automatic(A) or Manual(M). Automatic selection must be made in IDLE SETUP/SETUP menu. Manual selection by entering a value in the SAMPLE SETUP menu
1.5.2.8	Oil type	0…31	The type of contamination as mentioned in section 3.6
1.5.2.9	Concentration alarm	0…1,000 ppm	The value to be entered is the maximum concentration to be discharged.
1.5.2.10	Printing interval	1…10 min	The value to be entered is the interval at which data is normally logged. In case any abnormality occurs (as described in section 7.2.1.3) , data will be logged earlier.
1.5.2.11	Oil concentration indication	automatic / 0…1,000 ppm	Oil concentration can be Automatic(A) or Manual(M). Automatic selection must be made in IDLE SETUP/SETUP menu. Manual selection by entering a value in the SAMPLE SETUP menu.
1.5.2.12	Display contrast	710…790	Display contrast can be set between 710 and 790. Default is 750.
1.5.2.13	Date / time		The values to be entered are the current time and date. In case a GPS signal is available the GPS date and time automatically override the set date and time.

* In special occasions a maximum oil content up to 50 ppm can be entered.

7.2.1.5.3 Calibration flush mode (menu 1.5.3.0)

After the <FLUSH> key in the setup mode (**menu 1.5**) is pressed, the system prepares to go into sampling mode by initiating a calibration flush sequence.

The calibration flush sequence is used to clean the system prior to sampling and to check the condition of the detector cell and the system. This sequence consists of approximately 2 minute backward flush, 12 seconds window wash, 40 seconds zero check and a total of 4 minute forward flush and calibration (**total of approximately 7 minutes**).

After completion of the calibration flush sequence and if no failures are detected the system will automatically go into idle mode.

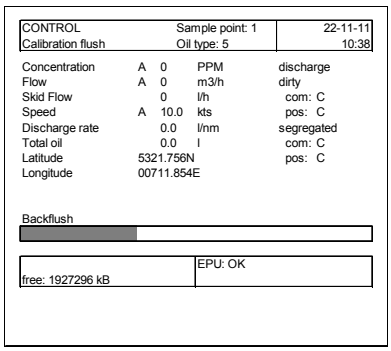


Figure 47

During the flush sequence no keys are available on the display.

When the sequence has finished, the keys will reappear and the system will be in idle mode (**menu 1.5.3**)

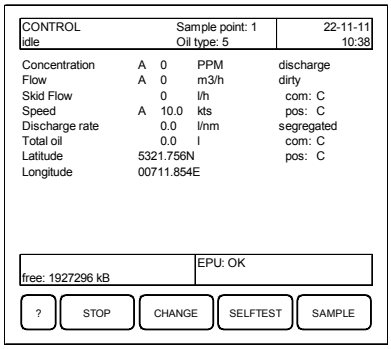


Figure 48

7.2.1.5.4 Idle mode (menu 1.5.3)

After the flush sequence has finished and idle mode has been reached the system is ready for discharge operations.

The system stays idle until the operator enters the next command.

From idle mode the following modes can be selected:

- ? information mode (**menu 1.5.3.1**)
- STOP shutdown mode (**menu 1.5.3.2**)
- CHANGE extended setup mode (**menu 1.5.3.3**)
- SELFTEST self test menu (**menu 1.5.3.4**)
- SAMPLE sample menu (**menu 1.5.3.5**)

7.2.1.5.4.1 Information mode (menu 1.5.3.1)

The information mode is entered when the < ? > key is pressed in **menu 1.5.3**.

The mode gives additional information about system operation and operational actions which can be taken if e.g. an alarm situation occurs.

Depending from which menu the information mode is activated, different texts will be displayed.

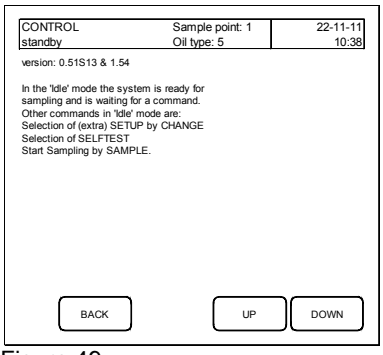


Figure 49

In **menu 1.5.3.1** a text with a short description about the use of the MCU in idle mode is given:

In the “Idle” mode the system is ready for sampling and is waiting for a command.
Other commands in “Idle” mode are:
Selection of (extra) SETUP by CHANGE
Selection of SELFTEST
Start Sampling by SAMPLE.

7.2.1.5.4.2 Shutdown mode (menu 1.5.3.2)
The shutdown mode is entered when the <STOP> key is pressed in **menu 1.5.3**.
If the shutdown mode is entered from idle mode (**menu 1.5.3**) the system will initiates a shutdown sequence.

The shutdown sequence consists of approximately 2 minutes backward flush and 2 minutes forward flush. After completion of the sequence the piping of the system has been cleaned, leaving the system in a clean condition for the next discharge run and the system will return to standby mode (**menu 1**).

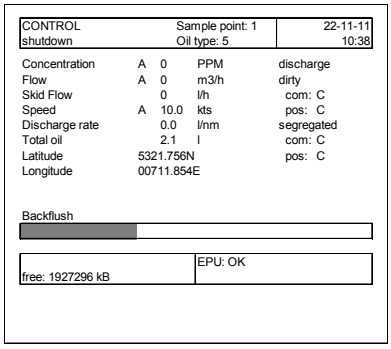


Figure 50

7.2.1.5.4.3 Idle setup mode (menu 1.5.3.3)

The idle setup mode is entered when the <CHANGE> key is pressed in **menu 1.5.3**.
In menus 1.5.2.1 – 1.5.2.13 the system has been setup for a specific discharge operation.
Next the system goes through the calibration flush sequence, cleaning and calibrating the system and reading it for discharging ballast water.
When a discharge operation has been carried out and for instance ballast another tank is to be discharged next with water with another type of contamination, it will be very inconvenient to go back to the previous setup menu.
Therefore a second, but limited, setup is available to change specific parameters without the need to go through the flush sequence again.

The following settings in the idle setup menu (**menu 1.5.3.3.1 - 1.5.3.3.9**) can be set:

Menu	Description	Range	Remark
1.5.3.3.1	Sample point	1…6	The value to be entered is the number of the sample point from which a sample is taken.
1.5.3.3.2	Discharge mode	clean ballast / dirty ballast	The value entered sets the mode in which the MCU operates. In dirty ballast mode the ship's speed and overboard discharge flow input parameters are computed and the oil concentration is calculated. In clean ballast mode the ship's speed and overboard discharge flow input parameters are not computed and only the oil content is registered. The maximum oil content permissible in this mode is 15ppm*.
1.5.3.3.3	Discharge alarm	0…30 l/NM	The value to be entered is the maximum quantity to be discharged per nautical mile (normally 30 l/nm).
1.5.3.3.4	Speed indication	automatic / 0…40 knots	Speed indication can be Automatic(A) or Manual(M). Automatic can be selected by pushing the - button. Manual can be selected by pushing the + button.
1.5.3.3.5	Flowrate indication	automatic / 0…32,000 m³/h	Flow rate can be Automatic(A) or Manual(M). Automatic selection must be made in IDLE SETUP/SETUP menu. Manual selection by entering a value in the SAMPLE SETUP menu
1.5.3.3.6	Oil type	0…31	The type of contamination as mentioned in section 3.6
1.5.3.3.7	Concentration alarm	0…1,000 ppm	The value to be entered is the maximum concentration to be discharged.
1.5.3.3.8	Oil concentration indication	automatic / 0…1,000 ppm	Oil concentration can be Automatic(A) or Manual(M). Automatic selection must be made in IDLE SETUP/SETUP menu. Manual selection by entering a value in the SAMPLE SETUP menu.
1.5.3.3.9	Display contrast	710…790	Display contrast can be set between 710 and 790. Default is 750.

* In special occasions a maximum oil content up to 50 ppm can be entered.

7.2.1.5.4.4 Self test mode (menu 1.5.3.4)
The selftest mode is entered when the <SELFTEST> key is pressed in **menu 1.5.3**.
In the self test mode and internal loop is checked and an overview is displayed of all alarms since the MCU is last powered down.

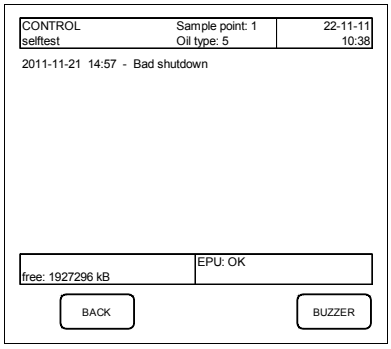


Figure 51

There is also a <BUZZER> key to test the internal buzzer. When the key is pressed the buzzer will sound for approximately 2.5 seconds.

7.2.1.5.4.5 Sample mode (menus 1.5.3.5)
The sample mode is entered when the <SAMPLE> key is pressed in **menu 1.5.3**, after which the system displays **menu 1.5.3.5**.

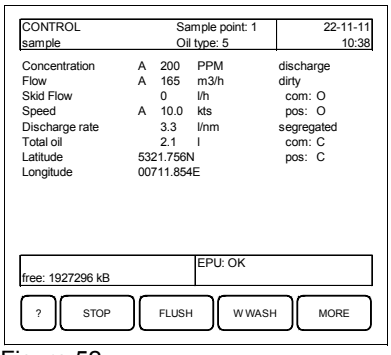


Figure 52

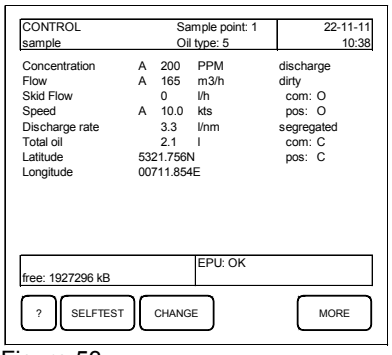


Figure 53

With the <MORE> key extra key options are shown.

In this operational mode the overboard discharge of ballast water is continuously monitored for oil content and the discharge rate is controlled. If an alarm situation occurs the ballast water will automatically be diverted from overboard to the slop tank to prevent any oil contamination. During the sample mode an **automatic window wash takes place every 3 minutes** to keep the detector cell in an optimal condition.

From the sample menu the following submenus can be selected:

- ? information mode (**menu 1.5.3.5.1**)
- STOP shutdown mode (**menu 1.5.3.5.2**)
- FLUSH manual flush mode (**menu 1.5.3.5.3**)
- W WASH manual windows wash mode (**menu 1.5.3.5.4**)
- SELFTEST self test menu (**menu 1.5.3.5.5**)
- CHANGE extended setup mode (**menu 1.5.3.5.6**)

7.2.1.5.4.5.1 Information mode (menu 1.5.3.5.1)
The information mode is entered when the < ? >key is pressed in **menu 1.5.3.5**.
The mode gives additional information about system operation and operational actions which can be taken if e.g. an alarm situation occurs.
Depending from which menu the information mode is activated, different texts will be displayed.

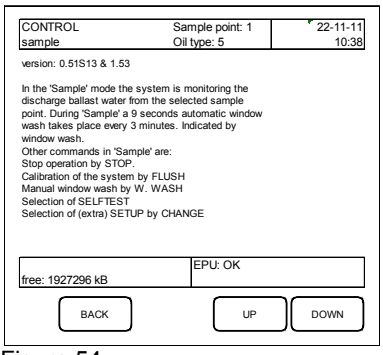


Figure 54

In **menu 1.5.3.5.1** a short description about the use of the MCU during sample mode is given:

In the "Sample" mode the system is monitoring the discharge ballast water from the selected sample point. During "Sample" a 9 seconds automatic window wash takes place every 3 minutes, indicated by window wash.
Other commands in "Sample" are:
Stop operation by STOP.
Calibration of the system by FLUSH
Manual window wash by W. WASH
< MORE >
Selection of SELFTEST
Selection of (extra) SETUP by CHANGE

7.2.1.5.4.5.2 Shutdown mode (menu 1.5.3.5.2)
The shutdown mode is entered when the <STOP> key is pressed in **menu 1.5.3.5**.
When the shutdown mode is entered from sampling mode (**menu 1.5.3.5**) the system will end discharging, close all valves and return to idle mode.

The shutdown sequence consists of approximately 2 minutes backward flush and 2 minutes forward flush. After completion of the sequence the piping of the system has been cleaned, leaving the system in a clean condition for the next discharge run and the system will return to standby mode (**menu 1**).

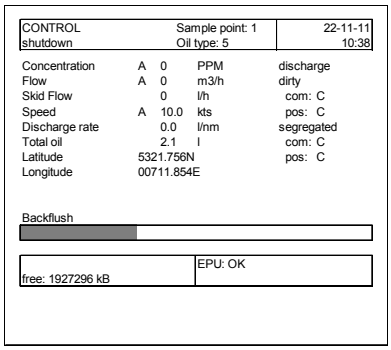


Figure 55

7.2.1.5.4.5.3 Manual flush mode (menu 1.5.3.5.3)
The manual flush mode is entered when the <FLUSH> key is pressed in **menu 1.5.3.5**
After the <FLUSH> key is pressed, the system initiates a manual flush sequence.
The sequence consists of approximately 12 seconds window wash and a total of 3 minute forward flush and calibration. After completion of the flush sequence and if no failures are detected the system will continue the discharge operation.
During the manual flush the ballast water is diverted to the slop tank instead of being discharged overboard.

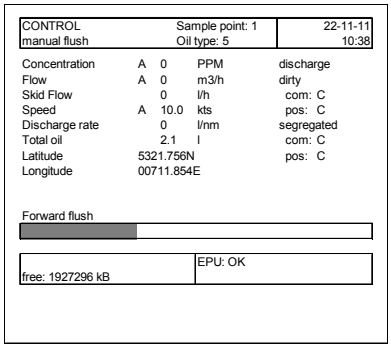


Figure 56

During the flush sequence no keys are available on the display. When the sequence has finished, the keys will reappear.

7.2.1.5.4.5.4 Manual window wash mode (menu 1.5.3.5.4)
The manual window wash mode is entered when the <W WASH> key is pressed in **menu 1.5.3.5**.
After the <W WASH> key is pressed, the system initiates a manual windows wash sequence to keep the detector cell in an optimal condition.
The sequence consists of approximately 12 seconds window wash.
During the manual window wash the ballast water continues to be discharged overboard.

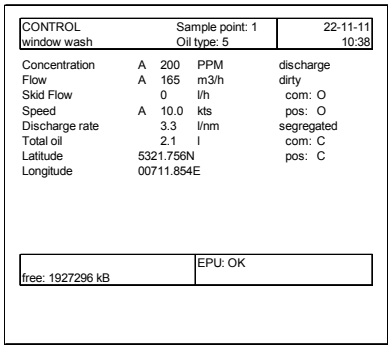


Figure 57

During the window wash sequence no keys are available on the display. When the sequence has finished, the keys will reappear.

7.2.1.5.4.5.5 Self test mode (menu 1.5.3.5.5)
The selftest mode is entered when the <SELFTEST> key is pressed in **menu 1.5.3.5.5**.
In the self test mode and internal loop is checked and an overview is displayed of all alarms since the MCU is last powered down.

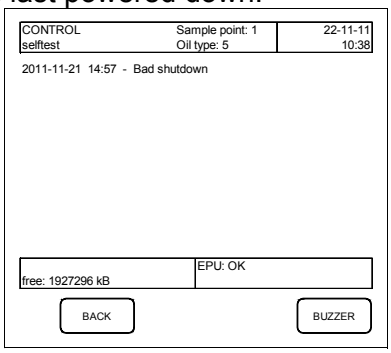


Figure 58

There is also a <BUZZER> key to test the internal buzzer. When the key is pressed the buzzer will sound for approximately 2.5 seconds.

7.2.1.5.4.5.6 Sample setup mode (menu 1.5.3.5.6)
The sample setup mode is entered when the <CHANGE> key is pressed in **menu 1.5.3.5**.
In menus 1.5.2.1 – 1.5.2.13 and menus 1.5.3.3.1 - 1.5.3.3.9 the system has been setup for a specific discharge operation. With these menus it is not possible to change parameters during operations.
With this sample setup menu it is possible to change a limited set of parameters while a discharge operation is being conducted.

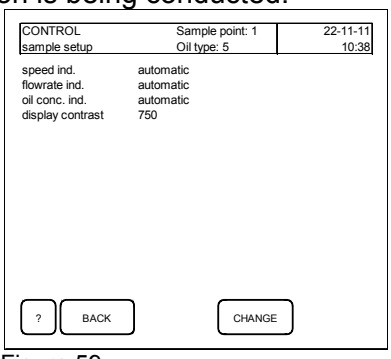


Figure 59

The following settings in the sample setup menu (**menu 1.5.3.5.6.1 - 1.5.3.5.6.4**) can be set:

Menu	Description	Range	Remark
1.5.3.5.6.1	Speed indication	automatic / 0…40 knots	Speed indication can be Automatic(A) or Manual(M). Automatic can be selected by pushing the - button. Manual can be selected by pushing the + button.
1.5.3.5.6.2	Flowrate indication	automatic / 0…32,000 m³/h	Flow rate can be Automatic(A) or Manual(M). Automatic selection must be made in IDLE SETUP/SETUP menu. Manual selection by entering a value in the SAMPLE SETUP menu
1.5.3.5.6.3	Oil concentration indication	automatic / 0…1,000 ppm	Oil concentration can be Automatic(A) or Manual(M). Automatic selection must be made in IDLE SETUP/SETUP menu. Manual selection by entering a value in the SAMPLE SETUP menu.
1.5.3.5.6.4	Display contrast	710…790	Display contrast can be set between 710 and 790. Default is 750.

When all parameters are set and the <BACK> key is pressed the system will return to sample mode (**menu 1.5.3.5**)

7.3 SHORT REFERENCE GUIDE FOR OPERATING THE MCU

NOTE:
The Oilcon® Oil Discharge Monitoring and Control System must be operated as directed under the regulations given in Marpol 73/78, to prevent discharge of oil contaminated water overboard. Where instructions in this manual may apparently conflict with the Marpol requirements, then at all times the Marpol regulations are leading.

CAUTION:
UNDER NO CIRCUMSTANCES SHOULD THE PUMP RUN WITHOUT LIQUID. THE PUMP HOUSING MUST FIRST BE FILLED WITH LIQUID, OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

Ensure that before operating the system, the following conditions are met:

- the control air supply is on
- the fresh water supply is on
- the electrical supplies are on
- the MCU is switched on
- the EPU is switched on
- the starter box is switched on
- all manual valves in the system are open
- the cargo pump is on standby

7.3.1 Discharging ballast water

Go through the following steps to start discharge operations:

- Switch on the MCU by turning the key switch to “Control” In the lop left corner of the display of MCU will indicate “Standby” If a GPS signal is present, the current GPS coordinates are shown. Also will the GPS signal set the current date and time.

- Press the CONFIG key to enter the configuration mode.

- Check if all parameter in the configuration are correct and change them if necessary.
  - Max. flow Flowmeter 1 at 20 mA 0...32,000 m³/h
  - Max. flow Flowmeter 2 at 20 mA 0...32,000 m³/h
  - K-factor skid flow meter 0…10,000 pulse/l
  - Flow Configuration Separated/Combined
  - K-factor measuring cell 0…10,000
  - Ship speed GPS/Ship’s log
  - K-factor Ships log 0…400 pulse/NM
  - Total ship’s volume 0…600 kTon
  - Status of the ship New/Old
  - Number of sample points 1…6
  - Name of sample point
    - port high
    - starboard high
    - port low
    - starboard low
    - stripping
    - segregated ballast

- Press the SETUP key to enter the setup mode.

- Check if all parameter in the setup are correct and change them if necessary.
  - Sample point 1…6
  - Discharge mode clean ballast/dirty ballast
  - Total oil limit 0…40,000 l
  - Reset total oil Yes/No
  - Discharge alarm 0…30 l/nm
  - Speed indication automatic/0…40 knots
  - Flowrate indication automatic/0…32,000 m³/h
  - Oil type 0…31
  - Concentration alarm 0…1,000 ppm
  - Printing interval 1…10 min
  - Oil concentration indication automatic/0…1,000 ppm
  - Display contrast 710…790
  - Date/time

- Press the FLUSH key to enter the setup mode and initiate the calibration flush sequence.
  - The valve V10 in the skid, opens to select clean water.
  - The valve V11 closes.
  - The selected sample valve opens.
  - The sample pump starts.
  - After 2 minutes of back flush a 12 second window wash is performed and the forward flush starts.
  - The valve V11 opens.
  - The window wash pump (V12) operates for 12 seconds
  - After 2 minutes of forward flush, the system changes to idle mode.
  - The valve V10 closes.
  - The selected sample valve closes.
  - The sample pump stops.

- Start the CARGO PUMP on idle speed.

- Press the SAMPLE key to continue monitoring and to enter the sample mode. The display changes to sample mode and the sample pump starts.

The monitor is now sampling from the selected sample point and will supply a readout of the measured oil content level. Provided no alarms are activated and after a short delay, 20 s or 2 min after an alarm situation is cleared, the overboard valve command will change to “OPEN”. This is indicated in the display by “COM: O”.

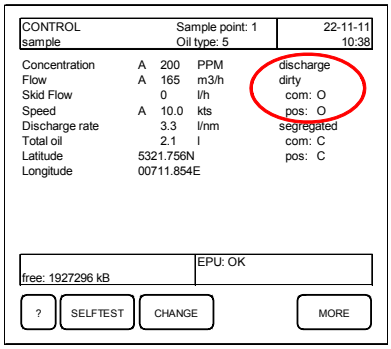


Figure 60

The overboard discharge will now automatically be diverted overboard.

- Increase the speed of the cargo pump. Watch the discharge rate on the MCU, it will increase as the speed of the cargo pump is increased.

NOTE:
If the discharge rate approaches the maximum permissible (i.e. 30 l/NM), it can be reduced by slowing down the cargo pump.

The system is now operating fully automatically. If any of the permitted limits are exceeded or if any other alarm is activated, an alarm will be given, the overboard valve will be closed and the ballast will be diverted to the slop tank.

When the system is running normally, the oil content will be displayed. At regular intervals a record of the monitor status is logged, which will build up to give a complete record of the ballast discharge. Whenever there is a discharge overboard the total oil discharged will be incremented.
Every 3 minutes the window wash will operate automatically. This is indicated in the display by windows wash. During the operation extra manual window flushing can be carried out, if required by pressing the W WASH key.
If it is suspected that the detector cell is particularly dirty, extra cleaning can be carried out by pressing the FLUSH key. It should be noted however, that this will cause the discharge overboard to be stopped automatically. The monitor will not be measuring the discharge overboard whilst flushing.

7.3.2 Shutdown of discharging operations

To stop operation the following steps should be performed:

- Stop cargo pumps
- Press the STOP key
  - The display changes from sample mode to idle mode.\
  - The overboard valve command changes from “COM: O” to “COM: C”.
  - The sample pump stops.
- Press the STOP key again.
  - The shutdown mode is started. This is an automatic flush sequence to clear the pipework of oil contaminated water, leaving the monitor clean for the next time it is used.
  - The display will indicate shutdown.
  - The valve V10 opens to select clean water.
  - The valve V11 closes.
  - The selected sample valve opens.
  - The sample pump starts.
  - After 2 minutes of back flush the system changes to the forward flush mode
  - Display indicates “Shutdown mode”
  - The valve V11 opens.
  - The window wash pump V12 operates for 12 seconds.
  - After 2 minutes of forward flush the system changes to standby mode. The display indicates standby
  - All valves are closed.
  - The sample pump is stopped.
- Switch the MCU to “OFF”.

The system is now shut off. All manual valves in the system may be closed and all auxiliaries may be shut off. The only active electronics will be the clock/calendar and the overboard valve position control. If for any reasons there is a change in the overboard valve position from CLOSE to OPEN or vice versa, a record is made of the event.

7.4 MISCELLANEOUS

This section is to describe problems that may be encountered during operation and the possible reasons.

7.4.1 Oil content reading higher than expected

During a normal discharge run of ballast water the ppm reading should be between 50 to 150 ppm assuming that sufficient time has been left to allow the oil to settle out in the tank.

The reading should be steady for most of the duration of discharge. If the reading varies rapidly with large deviations, it is likely that air is being entrained into the ballast water. This could be due to a partly filled overboard line, a cavitating cargo pump or a low suction pressure on the monitor sample pump casing causing air to enter the pump.

If the ppm reading is consistently high, press the FLUSH key. This will cause the monitor to run on fresh water for a short time. During the flush the ppm reading should go down to zero.

NOTE:
Pressing the FLUSH key will signal the MCU to stop discharging overboard, since the monitor is no longer sampling the ballast water.

Once the calibration check is completed the monitor will return to sampling the ballast water. If the reading returns to its previous level, then it is sure that the reading is accurate.

If there is any further doubt, the only solution is to stop the monitor and restart it again thereby forcing it to complete a full flushing cycle.

7.4.2 Oil level alarm

During a normal ballast discharge, the ppm reading should be quite low probably in the region of between 50 and 150 ppm, as the main bulk of the ballast tank is decanted. During this time, the rate of discharge in litres per nautical mile as calculated by the MCU, will also be steady and remain within the permitted limits. Obviously, as the level in the tank drops, there comes a time when the reading on the monitor will start to rise, as oil is stripped from the layer on the surface. It is difficult to predict at what depth of water this will occur due to a number of reasons:

- how long the tank had been left to settle
- whether or not heating has been applied
- weather conditions during discharge
- type of oil being carried

However, it is true to say that the entering of oil into the ballast water occurs when an appreciable level of separated water remains in the tank. The oil is pulled down from the oil-water interface due to swirling in tanks, powerful cross currents between the frames and watering over frames. This is all caused by a high rate of pumping. To reduce this effect and to allow a greater quantity of water to be pumped out, the rate of pumping must be reduced. This will have the effect of reducing the amount of oil entrained, and the ppm reading should therefore fall.
In this way, the monitor can be used as an accurate means of sensing the oil-water interface and ensuring that the maximum amount of water is discharged. If the “oil level” alarm should sound, reduce the pumping rate until the ppm reading falls and becomes steady. After a time the reading will rise again. Reduce the pumping rate further to let the ppm reading fall again. Repeat this cycle until the pumping reaches the oil-water interface at which time the ppm reading will rise rapidly and go over scale. The discharge will now be complete. Considerably more water will have been discharged using this technique, although it will have increased the time needed to discharge the ballast water.

7.5 OPERATIONAL ALARMS

NOTE:
At all times the Oilcon® Oil Discharge Monitoring and Control System must be operated as directed by MARPOL 73/78 to prevent discharge of oil contaminated water overboard.

There are necessarily a number of alarm conditions in the MCU. Irrespective of what caused the alarm, the result is the same. An alarm message will appear on the display alongside whatever caused the alarm. Also the internal buzzer will sound. A control signal will be sent to stop the ballast water discharge.
Should any alarm occur during normal operation, the alarm menu is displayed in the screen.
Press the ACK key to will silence the audible alarm and leave the alarm menu.
However the fault must be cleared before any discharge of ballast can take place.

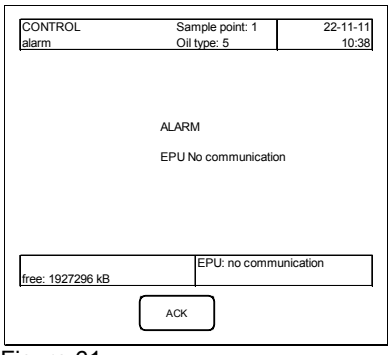


Figure 61

The following alarms can occur:

Alarm	Description
No air	If for any reason there is no air supply to the Oilcon® Oil Discharge Monitoring and Control System the NO AIR alarm is activated. The system will then return to Standby mode.
Overboard arrangement failure	The OVERBOARD ARRANGEMENT FAILURE is activated if during operation of the Oilcon® Oil Discharge Monitoring and Control System, in “Control” mode, a mismatch is detected between the overboard valve command and the overboard valve position indication.
Discharge ratio	If during operation of the Oilcon® Oil Discharge Monitoring and Control System the rate of discharge exceeds 30 l/NM the DISCHARGE RATIO alarm is activated. The system will continue operation in the Sample mode, although the ballast water discharge will be stopped. According to the Regulations the maximum discharge rate is 30 litres/nautical mile and the discharge rate alarm level is set to this limit, but may be set to a lower figure, if required. This can be done with the setup menu.
Total discharged oil limit	If the total discharge oil limit exceeds 1/30,000 of the last cargo carried, the TOTAL DISCHARGED OIL LIMIT alarm is activated. The limit is normally set by the operator and is calculated as: - 1/30,000 of the last cargo carried (for new ships) or - 1/15,000 of the last cargo (for existing ships). The result, in litres, is entered in the setup menu. If this limit is exceeded, no further discharge of ballast water can take place on that particular voyage. The TOTAL OIL DISCHARGED can only be reset at the start of a new ballast voyage. (i.e. after a cargo has been carried and the vessel is again ballasted). A record is logged when the total oil limit is reset.
Bad shut-down	If during the previous usage of the system the unit was shut-down in an incorrect manner, (i.e. without going through shutdown flush sequence) then this message will appear briefly on the display at the next start up. The event will be logged within the systems own internal memory.

Alarm	Description
No flow	If for any reason there is no flow through the Oilcon® Oil Discharge Monitoring and Control System the NO FLOW alarm is activated. The Sample pump will be stopped automatically to prevent any damage to the pump or motor. If in flush or shutdown mode the system will return to standby mode. When in Sample mode the system will go to the Idle mode.
Zero error	During the calibration check of the Oilcon® Oil Discharge Monitoring and Control System, during Flush or Manual Flush mode, the ZERO ERROR alarm can be activated if the flushing water is dirty, oily or if it contains air. The system will go to Idle mode and from there only the Shutdown mode can be selected, to resume operation after the fault is cleared. Thus a restart is made from Standby.
Path dirty	During the calibration check of the Oilcon® Oil Discharge Monitoring and Control System the PATH DIRTY alarm can be activated if the optical path between the laser transmitter and the direct receiver is obscured. The system will go to Idle mode and from there only the Shutdown mode can be selected, to resume operation after the fault is cleared. Thus a restart is made from Standby.
Power/communication failure	If during operation of the Oilcon® Oil Discharge Monitoring and Control System a fault develops in the communication link between the MCU and the EPU or a power failure condition occurs, then the POWER/COMMUNICATION FAILURE alarm is activated. The system will go to the Standby mode. However during such a situation the emergency power supply will take over, thus no data will be lost.
Led monitor error	If an optical LED failure is detected during operation of the Oilcon® Oil Discharge Monitoring and Control System the LED MONITOR ERROR alarm is activated.
Flow overrange Flowmeter 1 or 2	If during operation of the Oilcon® Oil Discharge Monitoring and Control System an over-range fault is detected in the flowmeter signal the FLOW OVERRANGE alarm is activated. The specific flowmeter-1 or -2 is shown.
Flow underrange Flowmeter 1 or 2	If during operation of the Oilcon® Oil Discharge Monitoring and Control System an under-range fault is detected in the flowmeter signal the FLOW UNDERRANGE alarm is activated. The specific flowmeter-1 or -2 is shown. This alarm is only applicable if the Oilcon® Oil Discharge Monitoring and Control System is equipped with two flowmeters.

In case an alarm is triggered, section 15 of this manual should be consulted for corrective actions.

7.6 SYSTEM FAILURES

IMPORTANT:
On any failure of the system the discharge should be stopped and the failure should be noted in the Oil Records Book. A manually operated alternative system shall be provided and may be used in the event of such a failure, but the defective unit must be made operable before the tanker commences its next ballast voyage, unless it is proceeding to a repair yard.

7.6.1 Auto/manual operation

In the occasion of a failure of one of the three transducers in the system (Oilcon® Oil Discharge Monitoring and Control System, ships log or discharge flowmeter) the input of these transducers can be changed from Auto to Manual. This can be done by following the next instructions:

1. operate the MCU until the system is in SET Up mode or the IDLE SET UP mode.
2. select the appropriate input (ship's speed, discharge flowrate or oil content).
3. change the appropriate input from automatic to manual or vice versa: Automatic input is indicated by "A", manual input by "M".
4. enter the value for that input with the numeric keys.

5. operate the system until back in IDLE mode.

7.6.1.1 Flowmeter

In the event of failure of the discharge flow metering system, the flow rate should be estimated by the best means available and entered into the MCU manually as described above.

The flowrate can be estimated by:

- cargo pump characteristic curves, a copy of which should be included in this manual;
- in the case of reciprocating pumps, the flow rate can be calculated by multiplying the number of strokes per minute x the number of cylinders x the volume per cylinder;
- alternatively, the flow rate can be calculated by taking ullage readings from the tank being discharged at various intervals and using the ullage tables to calculate the flow rate.

7.6.1.2 Ship's speed indicator

In the event of failure of the ship's speed indicating device, the speed should be estimated by the best means available and entered into the MCU manually as described in section 7.6.1.

The speed can be estimated by:

- the ship's speed log;
- the main engine rpm.;
- from the charted ship's positions.

7.6.1.3 Oilcon® Oil Discharge Monitoring and Control System

In the unlikely event of failure of measuring cell, the oil content should be estimated by the best means available and entered into the MCU manually as described in section 7.6.1.

The oil content in ppm cannot be estimated accurately other than with sophisticated test equipment. However, the following, if all used together, would give a rough indication of oil content.

- visual observation of the surface of the water around the ship;
- the use of an interface detector in the tank being discharged;
- the use of a part flow system where fitted.

7.6.1.4 Main Control Unit (MCU)

In the event of failure of the MCU, the following should be carried out:

1. discharge rate calculated by the following formula: $$R = \frac{C \cdot Q}{v \cdot 1000}$$

   Where:
   R = Discharge rate in litres per nautical mile
   C = Oil content in ppm
   Q = Flow rate in m³ per hour
   v = Ship's speed in knots

2. discharge total can be calculated by the following formula: $$OD = R \cdot v \cdot t$$

   Where:
   OD = Oil discharged in litres
   R = Discharge rate in litres per nautical mile
   v = Ship's speed in knots
   t = Discharge time in hours

3. discharge control can be carried out by manual operation of valves and pumps. This can also be done in the event of failure of the discharge valve actuating circuits or cargo pump trips.

4. manual recording of all data, calculations, times and operations in the Oil Records Book.

7.7 SYSTEM OVERRIDES

The MCU provides a number of output signals to allow flexible means of controlling the ballast water discharge system. Two outputs are under the direct control of the MCU and these are used to automatically control the discharge system: to stop the discharge when the alarm points are reached and to permit discharge when the discharge rate of oil is within limits. Overriding of the MCU should only be considered if the MCU itself has failed or if special circumstances prevail.

There may be occasions when it is imperative to override the control signal from the MCU to the ballast discharge system, if automatic control is fitted. The control switch on the MCU front panel has a position marked “Console” with the switch in this position the automatic control is overridden, which means that the control of the valves, pumps etc. in the ballast discharge system has reverted to the cargo control room console. In the position marked “Control Unit”, control of the ballast discharge system is entirely from the MCU. The fact that the switch has been operated will be recorded.

7.7.1 Transducer override

On occasions, one of the three transducers in the system (Oilcon® Oil Discharge Monitoring and Control System, ship’s log or discharge flowmeter) may be defective. For this situation, the input of these transducers can be changed from Auto to Manual. This can be done by entering the setup mode or the idle setup mode and selecting the required input signal. The input mode is indicated alongside the input by “A” for automatic and by a value for manual.
Any of the 3 inputs and any combination of these inputs can be set to manual. Any change of mode from automatic to manual or vice-versa will be recorded.

7.7.2 Discharge control

The main purpose of the MCU is to control the discharge of ballast water overboard. The MCU controls an internal relay which, when suitably connected, can be used to open or close an overboard valve, or start and stop a cargo pump. The specific installation on any ship may vary.

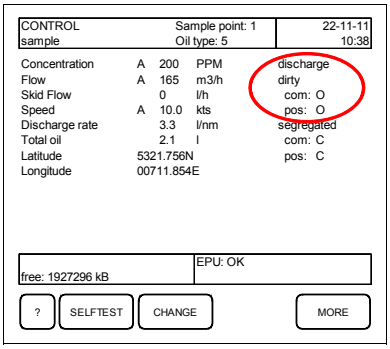


Figure 62

The position of this internal relay is shown on the display on the screen and is either “O” (open) or “C” (closed). The relay will be closed when:

- the Oil Discharge Monitor is switched off or is self-flushing
- when the discharge rate exceeds 30 l/NM
- when the total oil discharged exceeds 1/30,000 of the last cargo carried
- should there be any other alarm displayed on the MCU

When the monitor has completed the Flush cycle and has switched to sample, there will be a 10 s delay before the valve position changes to open. If the discharge is being restarted after an alarm

condition, then there will be a 2 min delay after the alarm has been cleared before the valve position changes to “O” (open).

7.7.3 Discharge control answer-back

It is necessary for the MCU to know if the command output has been obeyed correctly. Hence, an input is provided to signal the “status” of the discharge control system. The input could be from e.g. a micro switch on the overboard valve. The answer-back is shown on the display as “*POS”* and status is shown as “O” (open) or “C” (closed).

If the MCU is in “Control” mode and the command and status indications do not agree, after 2 min, an alarm will be triggered to indicate a fault. The overboard valve command will then be “CLOSE”.

The discharge rate and total oil discharged calculations are performed once the status is open. This means that if the overboard valve is opened even when the command signal is to close the valve, then the normal calculation will be carried out and the amount of oil discharged will be recorded.

8 MAINTENANCE

8.1 MAINTENANCE GENERAL

The Oil Discharge Monitor and Control System is an assembly of components forming a complete system. It comprises a mix of pneumatic, electronic and mechanical components. Once a control system is functioning correctly there is no test, or tests, which can be applied to guarantee successful operation for a stated period of time.
Random failure of components can occur and such random failures can never be forecast. In consequence, satisfactory operation, in the way the system was designed to operate, is the only test to apply. This involves frequent operation of the monitor, especially if the monitor is shut down for long periods.
A test run, once a month, will ensure that the monitor will work correctly when it is required.
Dirt, corrosion and to a lesser extent wear are the enemies of control. This means that clean conditions must be maintained in the area of the monitoring equipment.

Pneumatic and hydraulic components require little maintenance.
The various moving parts in the system should be free from friction and in good working order.
Oil should not be applied to pneumatic components.

Connections should be tight. Loose connections do not only waste air but produce unsatisfactory operation and performance.

One of the greatest problems with pneumatic systems is the maintaining of a supply of clean, dry air at a constant pressure. Moisture, oil or foreign particles carried into the system from the air supply will cause problems. Pneumatic valves and controllers operating with clean dry air require virtually no maintenance.

SAFETY PRECAUTIONS:
MAKE SURE THAT ALL SAFETY REQUIREMENTS AS DESCRIBED IN SECTION 4.1 ARE MET BEFORE ANY WORK IS COMMENCED.

NOTE:
If any work is carried out on the monitor, the following precautions should be taken before any work is commenced:

- Thoroughly clean the outside of all fittings, pipes and components, and surrounding structure before any work commences.
- When pipe lines are disconnected fit dust caps to pipes and unions, mask any exposed surfaces and make certain that foreign matter cannot enter the system.
- If flushing pipes, use a clean inert solvent, from a clean container.

8.2 ROUTINE MAINTENANCE

There is little routine maintenance that can be carried out on the Oilcon® Oil Discharge Monitoring and Control System. The major requirement is to ensure that the lubricator in the system is kept topped up and a regular check of the air regulator housings for excess water.

8.2.1 Sample pump/motor lubricator

The sealing device of the sample pump requires no maintenance or adjustment. When a new seal is being run in, small leakage may occur momentarily.
If any water leakage occurs, this will drip out of the 2 mm keyway at the bottom side of the pump casing, visible from the pump room side.
Proper functioning of the gas seal located in the centre of the pump main plate relies on the presence of oil for lubricating, sealing and cooling purposes.
The oil reservoir shall always be sufficiently filled with oil. It can easily be filled by opening the spring-loaded cap on top, and pouring the oil in.
There is no need to disassemble any part of the support assembly.
For lubricating oil to use of a light duty type of machine oil is recommended, or Automatic Transmission Fluid.

The viscosity of the oil must be within the range of:

- 20 – 100 cSt
- 20 – 100 cPs
- 100 – 500 SSU
- 3 – 14° Engler

Suggested products are:

Machine oil

- AGIP OSO 22 or 32
- Castrol MLV30
- Castrol Highspin AWH-- M68
- Elf Olma DS 46
- Elf Hydrelf DS 46
- Esso Teresso 32 or 46
- Esso Nuto-H 32 or 46
- Kroon Carsinus U68
- Kroon Abacod MEP 68
- Kroon Perlus AF
- Pennzoil AW Hydraulic 22 or 32
- Pennzoil Pennzgear 150 or 220
- Shell Tellus 22 or 37
- Total Azolla ZS 32
- Total Preslia 32
- Texaco ISO VG 32 or 68

Automatic Transmission Fluid

- AGIP ATF 2D
- Elf Transomatic
- Esso ATF-D
- Kroon Almurol
- Pennzoil ATF
- Shell Donax TA
- Total Fluïde ATX
- Texaco Texamatic 4261

Biodegradable:

- Castrol Carelube SES32

WARNING:
ATF-TYPES OF OIL ARE NOT TO BE MIXED WITH GENERAL MACHINE OIL.

8.2.2 Air regulators

For correct and fault free functioning of pneumatic components it is advised to regularly check and drain the regulator housing of excess water. If a great deal of water is found, the filter in the regulator house should be replaced. Also a check should then be performed on the ship's control air system, compressors, air-dryers etc.

8.2.3 Cleaning the detector cell windows

Drawing **0806-1279** shows the detector cell and will help to visualize the following.

NOTE:
The internal parts of the detector cell have been chemically treated. it is important to ensure that the coating remains intact and that no bare metal has been exposed.

Cleaning of the detector cell is normally not required but in cases where repeated failure of the system to qualify occurs, the following cleaning procedure can be undertaken:

1. Relieve any pressure from the cell body.
2. Remove the upper pipe clamp above the cell.
3. Remove mounting bolts of the flow regulator.
4. Unscrew the upper coupling on flow sensor.
5. Unscrew the four upper hex drive bolts.
6. Remove the upper connection piece of the measurement cell and slide out to the front of the skid assembly.
7. The inner parts of the cell can now be cleaned by using the cleansing brush (part number **0609-0290**) provided.
8. Re-assembly of the cell is the reverse procedure, taking care that the O-ring is properly seated.

8.2.4 Window wash pump

No maintenance on this unit is envisioned. Should the unit fail to operate, repairs can be carried out as described in section 9.2.

8.2.5 Skid shuttle valve

No maintenance on this unit is envisioned. Should the unit fail to operate, a replacement unit should be installed. If any water leakage through the end cap bleed holes is detected, the assembly should be delivered to a qualified VAF Instruments service point for overhaul.

8.2.6 2-Way pneumatic valve(s)

No maintenance on this unit is envisioned. Should the unit fail to operate, a replacement unit should be installed. If any water leakage through the end cap bleed holes is detected, the assembly should be delivered to a qualified VAF Instruments service point for overhaul.

8.2.7 Zero output check of the differential pressure transmitter

1. Open equalising valve of DPT.
2. The FLOW indication on the MCU should now read zero. If reading is not zero, adjust zero point at DPT, in accordance with section 9.4.1, until reading is zero.
3. Close equalising valve of DPT.

8.3 TEST AND CHECK-OUT PROCEDURE

CAUTION:
UNDER NO CIRCUMSTANCES SHOULD THE PUMP RUN WITHOUT LIQUID. THE PUMP HOUSING MUST FIRST BE FILLED WITH LIQUID, OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

Before a test is carried out, the person in charge should familiarise himself/herself with the operation of the system and ensure the following conditions are met:

- Control air supply is on
- Fresh water supply is on
- Electrical supplies are on
- Main Control Unit is switched on
- Electro Pneumatic Unit is switched on
- Starter box is switched on
- All manual valves in the system are open
- Cargo pump is on standby

NOTE
The MCU will divert flow into the slop tank during the test.

Proceed as follows:

1. Turn the key switch in the “Control” position.
2. Press the <SETUP> key to enter the “setup mode”.
3. Press the <CHANGE> key and next press the <NXT> key until “*total oil limit*” is displayed.
4. Change the “*total oil limit*” to 40 l.
5. Press the <NXT> key to display “*reset total oil*”.
6. Change the “*reset total oil*” to “*Yes*”.
7. Press the <NXT> key until “*speed ind*.” is selected. Use the < + > and < - > keys to change the ship’s speed to 15 knots.
8. Press the <NXT> key until “*flowrate ind.*” is selected. Use the numeric keys to enter a flow rate of 1000 m³/h.
9. Press the <NXT> key until “*oil conc. Ind.*” is selected. Use the numeric keys to enter a oil concentration of 400 ppm.
   Please note that the “conc. alarm” must be > 400ppm.
10. Press the <OK> key to exit the “setup mode”.
11. Press the <FLUSH> key. The system will *not* perform the “back flush” sequence but will immediately go into “idle mode”.
12. Press the <SAMPLE> key to start the “sample mode”.
13. Check the display of the MCU for correct information.

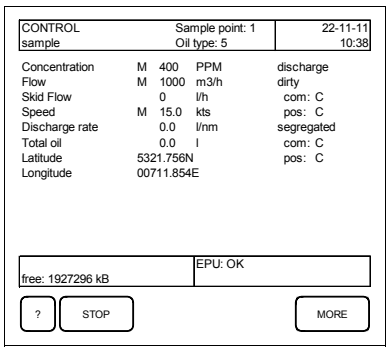


Figure 63

14. After approximately 10 seconds, the signal will be given to open the overboard valve and to close the slop tank valve. This is indicated on the display as follows:

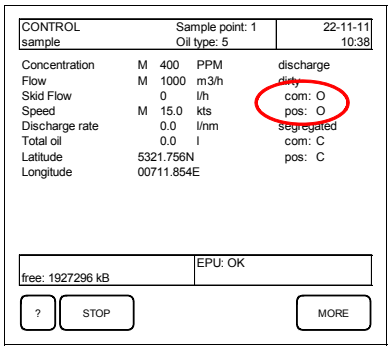


Figure 64

15. In the case of this vessel, check that the valves have indeed been operated. On the display of the MCU this is indicated by the change of POS: from “C” to “O”.
16. By pressing the <STOP> key, the system will return to “idle mode” and the signal to close the overboard valve and open the slop tank valve will be given.

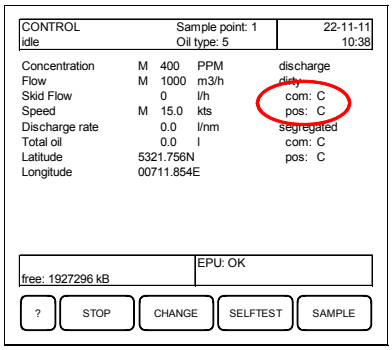


Figure 65

17. In the case of this vessel, check that the valves have indeed been operated.
18. Press the <CHANGE> key twice to select the “idle setup mode”.
19. Press the <NXT> key until “*flowrate ind.*” is selected. Use the numeric keys to enter a flow rate of 2000 m³/h.
20. Press the <OK> key and the <BACK> key to go back to the “idle mode menu”.

21. Check the display of the MCU for correct information.

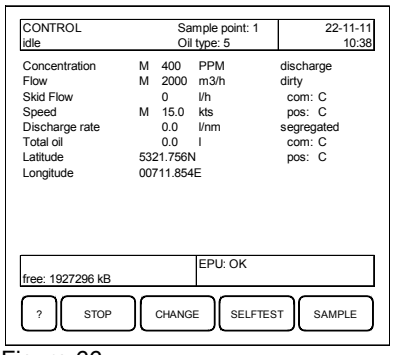


Figure 66

22. Select the sample mode by pressing the <SAMPLE> key. Since the discharge rate is now set too high, the system will trigger an alarm immediately.
The overboard discharge valve signal will not change from close to open.

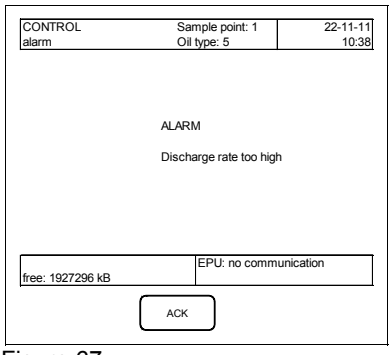


Figure 67

23. Press the <ACK> key to stop the alarm buzzer.
24. Press the <STOP> key to return to “idle mode”.
25. Press the <CHANGE> key twice to select the “idle setup mode”.
26. Press the <NXT> key until “*flowrate ind.*” is selected. Use the numeric keys to enter a flow rate of 1000 m³/h.
27. Press the <OK> key and the <BACK> key to return to “idle mode”.
28. Press the <SAMPLE> key to start the “sample mode”.
29. Check the display of the MCU for correct information.

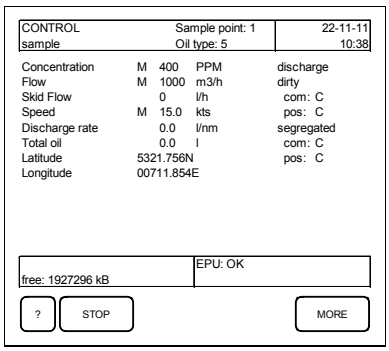


Figure 68

30. After approximately 10 seconds, the signal to open the overboard valve and to shut the slop tank valve will be given. Which is indicated on the display as follows:

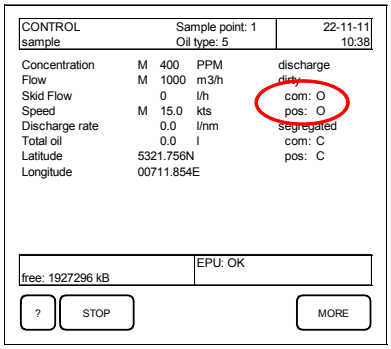


Figure 69

31. In the case of this vessel, check that the valves have indeed been operated. On the display of the MCU this is indicated by the change of POS: from “C” to “O”.

32. The discharged oil indicated on the display by “*Total oil*” will increase. Allow the oil discharge to increase till it reaches 40 litres.

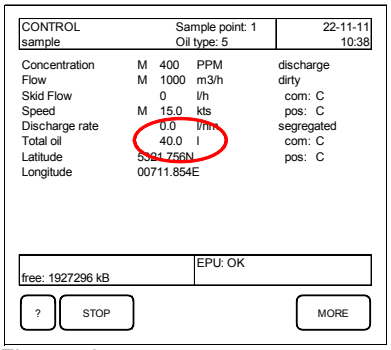


Figure 70

33. When the “*Total oil*” reaches 40 litres the signal will be given to close the overboard valve and to open the slop tank valve and an alarm is triggered.

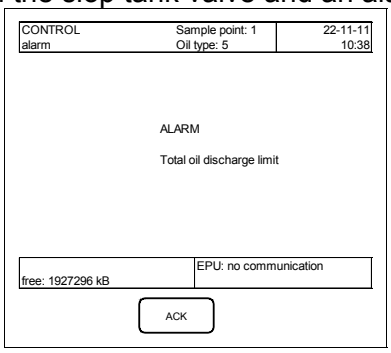


Figure 71

34. Press the <ACK> key to stop the alarm buzzer.
35. In the case of this vessel, check that the valves have indeed been operated.
36. Press the <STOP> key to return to “idle mode”.
37. Press the <STOP> key again to return to “standby mode”.

38. Press the <SETUP> key to enter the “setup mode”.
39. Press the <CHANGE> key and press the <NXT> key until “*reset oil total*” is displayed.
40. Change the “*reset oil total*” to “*Yes*”.

41. Press the <NXT> key until “*speed ind.*” is selected. Use the “+” and “-” keys to change the ship’s speed to “*automatic*”.
42. Press the <NXT> key until “*flowrate ind.*” is selected. Use the numeric keys to change the flow rate to “*automatic*”.
43. Press the <NXT> key until “*oil conc. ind.*” is selected. Use the numeric keys to change the oil concentration to “*automatic*”.

44. Press the <OK> key to exit the “setup mode”.
45. Press the <FLUSH> key. The system will now perform the “Back flush” sequence (approximately 7 minutes). After the flush sequence has finished the system will go into “idle mode”.

46. Check the display of the MCU for correct information.

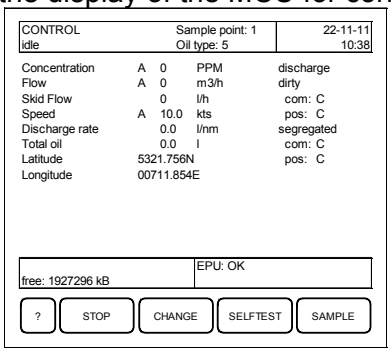


Figure 72

47. Start the cargo pump.
    NOTE: the MCU will divert the flow into the slop tank.
48. Press the <SAMPLE> key to start sampling. Check that the concentration [ppm] indication on the MCU is changing.
49. Press the <STOP> key to stop sampling and to return to “idle mode”.
50. Press the <CHANGE> key twice to select the “idle setup mode”.
51. The “*sample point*” is selected. Use the “+” and “-” keys to change to the next sample point.
52. Press the <OK> key and the <BACK> key to return to the “idle mode”.
53. Press the <SAMPLE> key to start sampling.
    - Check that the correct sample point is indicated on the MCU.
    - Check that the correct sample probe is selected.

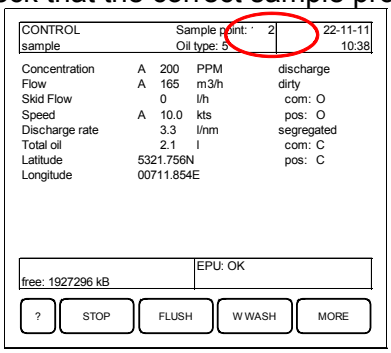


Figure 73

54. Repeat step 49 to 53 for each sample point.
55. Press the <STOP> key to stop sampling and to return to “idle mode”
56. Press the <CHANGE> key twice to select the “idle setup mode”.
57. Press the <NXT> key until “*oil type*” is selected. Use the “+” and “-” keys to change to the next oil type.
58. Press the <OK> key and the <BACK> key to go back to the “idle mode menu”.
59. Check if correct Oil type is indicated on MCU.

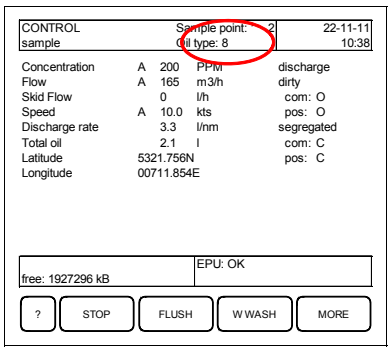


Figure 74

60. Repeat step 56 to 59 for each oil type.
61. Press the <SAMPLE> key to start the “sample mode”.
62. Press the <W WASH> key to activate the “windows wash” sequence.
    The system initiates a manual windows wash sequence to keep the detector cell in an optimal condition.
    The display will indicate “window wash”.

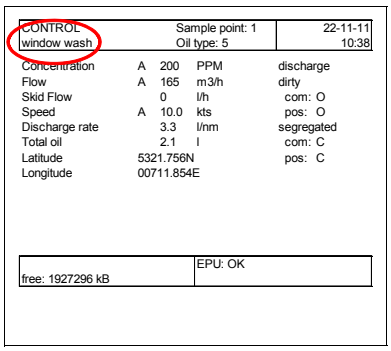


Figure 75

During the window wash sequence no keys are available on the display. When the sequence has finished, the keys will reappear.

63. Press the <FLUSH> key to select the “manual flush mode”.

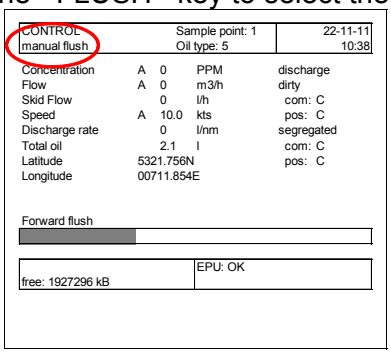


Figure 76

- Check that valve V10 opens for approximately 2 minutes.
- Check that the concentration [ppm] indication on MCU reads zero.

64. Test the “NO FLOW” alarm by manually shutting the sample inlet valve on the skid assembly.
    - Check that the sample pump is stopped after approximately 2 minutes
    - Re-open sample inlet valve after test.

65. Press the <ACK> key to stop the alarm. The MCU returns back to “idle mode”.

66. Press the <SAMPLE> key to start the “sample mode”

67. Check that the ship’s speed, flow rate and oil concentration are all displayed on the MCU Wait for the overboard discharge valve to open. This is indicated by the change of POS: from “C” to “O”.

68. Regulate the cargo pump speed and back pressure to obtain a flow rate equivalent to approximately 50 % of the rated capacity of the flowmeter. Check the accuracy of the flowmeter against ullage readings or cargo pump characteristic curves.

69. *Only in case of two flowmeters:* Test the underrange alarm by reducing the flow. Shut the overboard valve and the recirculation valve will go open. The alarm will be triggered. Increase the discharge flow and press <ACK> to stop the alarm.

70. Press the <MORE> key and accordingly the <SELFTEST> key to select the "selftest mode”. The MCU screen shows the most recent alarms.
    Press the <BUZZER> key to test the buzzer alarm sound.

71. Press the <BACK> key to return to “sample mode”.

72. Press the <STOP> key to select “idle mode”.

73. Stop the cargo pump.

74. Turn the key switch on the MCU to <CONSOLE> position and check the manual control of the overboard discharge valve and slop tank valve from the cargo control console.

75. Turn the key switch on the MCU to <CONTROL> and check that the *manual control* of both overboard discharge valve and slop tank valve from the cargo control console is *not possible*.

76. Press the STOP key to select the “shutdown mode”.
    Check operation of SHUTDOWN flushing cycle as follows:
    - The valve V10 and valve V11 open.
    - The sample pump runs.
    - After 2 minutes valve V11 should close.
    - The window wash pump will operate for a approximately 12 seconds.
    - After a further 2 minutes valve V10 will close and the pump will stop.
    - The system is now in a STANDBY mode.

77. After the test, take the data files from the MCU and check the data files are ok.

78. Inspect the system for evidence of any leaks.

9 REPAIR OR REPLACEMENT

SAFETY PRECAUTIONS:
MAKE SURE THAT ALL SAFETY REQUIREMENTS AS DESCRIBED IN SECTION 4.1 ARE MET BEFORE ANY WORK IS COMMENCED.

NOTE:
If any work is carried out on the monitor, the following precautions should be taken before any work is commenced:

- Thoroughly clean the outside of all fittings, pipes and components, and surrounding structure before any work commences;
- When pipe lines are disconnected fit dust caps to pipes and unions, mask any exposed surfaces and make certain that foreign matter cannot enter the system;
- If flushing pipes, use a clean inert solvent, such as inhibited methyl chloroform, from a clean container.

9.1 DETECTOR CELL

Drawing **0806-1279** shows the detector cell and will help to visualize the following.

NOTE:
The internal parts of the detector cell have been chemically treated. it is important to ensure that the coating remains intact and that no bare metal has been exposed.

9.1.1 Removing the detector cell

The detector cell does not require repairs but only removal for complete unit replacement.
To replace the detector cell the following procedure must be taken:

1. Relieve any pressure from the cell body.
2. Remove the upper pipe clamp above the cell.
3. Remove mounting bolts of the flow regulator.
4. Unscrew the upper coupling on flow sensor.
5. Unscrew the four upper hex drive bolts.
6. Remove the upper connection piece of the measurement cell and slide out to the front of the skid assembly.
7. The centre section of the detector cell can now be removed.
8. The detector cell centre section must be removed and replaced including the attached cable. As such the connection box must be opened and the cable gland loosened and terminals undone.
9. The detector cell and cable can now be removed and replaced.

9.1.2 Reinstalling the detector cell

1. Ensure the lower O-ring is properly seated.
2. Slide the new centre section of the detector cell into place.
3. Slide the upper section of the cell into place and line up the holes.
4. Insert the four hex drive bolts and tighten the bolts.
5. Reconnect the upper pipework connection.
6. Tighten the pipe clamp and mounting bolts for the flow sensor.
7. Reconnect the cable inside the connection box and tighten the cable gland

9.2 WINDOW WASH PUMP

Drawing **0871-1213** shows the window wash pump and will help to visualize the different parts.

NOTE
When the pump is disassembled for repairs, all matched parts should be handled carefully to avoid damage to lapped or honed surfaces.

CAUTION
Repair work must be carried out by qualified specialist personnel.
Ensure absolute cleanliness. Even the smallest impurities may cause serious damage to precision machined hydraulic and pneumatic components.

9.2.1 Disassembling the window wash pump

1. Isolate the pump and relieve any pressure from the pump.
2. Disconnecting the 2 water pipe lines and the air supply line.
3. Remove the pump from the skid assembly to a clean and well-lit work place.

9.2.2 Air side maintenance

1. In the eventuality of an air drive malfunction maintenance should be performed on the spool valve housing (15). Inspect this first and maintenance if necessary, prior to retesting before further disassembly of the air drive.
2. The spool valve housing (15) is most easily removed by removing the three Allen screws (26) and carefully lifting it up. Behind the spool valve housing O-rings are located. The spool (18) and spool valve sleeve (16) can be pushed out by removing the snap ring (23) first. Spare parts kit **0390-1403** contains all the replacement parts.

9.2.3 Water side maintenance

1. The inlet and outlet couplings are provided with non-return valves. Should a leakage occur on the water side, replacement of the O-rings (58) should be carried out. Remove inlet and/or outlet gland completely and replace the O-ring (58) by a new one.
   Spare parts kit **0390-1403** contains all the replacement parts.
2. If water is leaking from the wet side to the air side then the following parts should be replaced. Entrance to the parts will be gained through the hex head screws (37). Remove the top cap (1). Remove the air cylinder (28). Remove the air piston (30). Place the lower assembly into a bench vice. Remove the cap nut (44). Now the O-rings (17) (59), glide ring (47), retainer ring (49) and seal (50) can be replaced.
   Spare parts kit **0390-1403** contains all the replacement parts.

9.2.4 Re-assembling the window wash pump

1. Before starting the reassembly operations, all metallic parts are to be washed thoroughly in solvent.
2. The air piston (30), air cylinder (28) and O-rings should be lubricated on assembly with lubricant provided in the spare parts kits.
3. Re-insert the air piston (30).
4. Place the air cylinder (28) and the top cap (1) onto lower pump body, taking care of the two O-rings (4) to sit well and are not “pinched”.
5. Place the pump into the skid assembly and reconnect the water and air service pipes.

9.3 SAMPLE PUMP

Drawing **0806-1260** shows the pump/motor and will help to visualize the following:

9.3.1 Disassembling the pump/motor

1. Drain the pump and piping. On the pump casing a drain plug is provided. If repair to the impeller or rotating parts of the mechanical seal is required, the piping can remain in place. Otherwise, remove the suction and discharge piping from the pump.
2. Remove the 8 nuts (7) and washers (38) from the pump cover.
3. Remove the cover (5) from the pump casing, preferably utilising the 2 x M6 off-jacking screws. Be careful not to damage the set of gasket rings (4).
4. If only the impeller (10) is to be changed out, pull it out of the casing. If it sticks, gently use 2 snap grips and apply little force evenly. Be careful not to be injured by the sharp impeller vanes and also not to damage the impeller. The keyway for the impeller is glued in place in the factory and should not be disturbed.
5. For access to the mechanical seal (9), the coupling (14) is to be removed. For this purpose, the impeller can be left in place and be blocked with a tool having a soft end. Be careful not to be injured by the sharp impeller vanes, and also not to damage the impeller. Loosen the hexagon socket head cap screw (12) of the coupling (14). Then remove the impeller, and the bolt (12) with the o-ring (13).
6. Pull the coupling from the motor shaft. For this purpose a M16 thread is provided, enabling use of a bolt as pull handle. Be careful as the rotating part of the mechanical seal (9) will come off with the shaft sleeve. Prevent the seal part from striking the pump casing when it comes off. Do not damage the sealing ring and store it in a clean cloth at a safe place.
7. For further disassembly remove the 3 hexagon socket head bolts (16) from the flange (22). Pull the pump casing (2) with fitting ring (22) from the main plate. Care should be taken for the stationary ring of the mechanical seal, this will come off together with the pump casing. This ring should not strike the shaft, otherwise it may be damaged. Be aware that the key (31) should be kept in place.

NOTE:
The gas tight seal will be compromised if the following steps are taken. ensure replacement parts are at hand.

WARNING:
GAS TIGHT INTEGRITY OF THE BULKHEAD WILL BE SHORTLY COMPROMISED. ENSURE ALL SAFETY REGULATIONS ARE FOLLOWED AND BLANKING PLATES ARE AVAILABLE IF THE REPAIR OF THE UNIT IS EXPECTED TO TAKE ANY LENGTH OF TIME.

8. If deemed necessary the rings forming the gas seal can be removed. Remove the oil reservoir on engine room side of bulkhead. Pull out the first oil seal (25), the lantern ring (26) and the second oil ring. The oil seals will certainly be damaged and need to be replaced.
9. Clean the oil that will come out of the oil seal chamber.
10. Clean all components and store these at a safe place.
11. Now the electric motor (32) can be removed from the flange (22). Remove the bolts and washers (23, 24) from the motor flange. Pull the motor from its fitting.
12. Seal the hole of the motor shaft using e.g. tape or a plug diameter 30 mm. Protect the sleeve on the motor shaft from damage. If a new motor is being installed the bushing (27) is supplied fitted to the original VAF Instruments spare part.

9.3.2 Reassembling the pump/motor

Have all parts cleaned and be free of burrs. Have new gaskets, oil and if required oil seals available.

1. If the electric motor was removed or replaced, inspect the surface of the bushing (27) for scratches. If the surface is damaged, the VAF Instruments motor and bushing will need to be replaced completely, as these items are critical for the gas tight seal.
2. If the oil seals (26) were removed, install these now, together with lantern ring (25). Take care not to damage the oil seals. If the oil seals (26) are still in place, make sure these are not damaged during reinstallation. Ensure the lubricating oil channel is clean. Smear a small amount of oil over the seals. Install the electric motor (32). The terminal box should preferably be located at the top.
3. Smear some oil on the face of the pump house (2). Mount the pump house (2) on the pump face (22) with the 3 hex socket head cap screws (16). Use water and soap on the mechanical seal (9) and press this into the pump house over the slightly prominent motor drive shaft.
4. Insert the woodruff key (11) into the coupling (14) with Loctite Retainer 542. Mount the coupling (14) with attention to the mechanical seal onto the motor shaft. (The sleeve should slip easily onto the shaft). Care is to be taken to ensure the keyway in the coupling mates with the drive pin (31) in the motor shaft.
5. Install the impeller (10) onto the shaft, taking care to line the keyway up with the woodruff key (11). The impeller should fit readily onto the shaft. There is no difference between frontside or backside. However, when refitting the same impeller it is preferable to adhere to the original position.
6. Place the casing cover (5) on the pump casing (2), with a new O-ring gasket (8). Re-use all of the shims (4). If a shim gets damaged it must be replaced with a new one of exact the same thickness, otherwise pump performance will be affected or the pump may even jam. Gently tighten all cover nuts (7).
7. Check that the pump rotates freely by hand. This can be done at the cooling fan of the electric motor.
8. Check the oil level in the reservoir (38), if required refill.

CAUTION:
UNDER NO CIRCUMSTANCES SHOULD THE PUMP RUN WITHOUT LIQUID. THE PUMP HOUSING MUST FIRST BE FILLED WITH LIQUID, OTHERWISE THE PUMP WILL SEIZE AND DAMAGE WILL OCCUR.

9. Reconnect the suction and discharge piping to the pump casing. Reinstall the drain and vent plugs after filling the pump casing and suction line with water.
10. Reconnect the pump motor to the mains supply. Make sure that all piping is installed, and the pump is filled with water. Make sure any discharge valve is opened before starting, enabling air to be released.
11. Check the direction of rotation by switching on the pump motor for a short moment only! Look at the motor fan and notice the direction in which the fan spins. This must be CLOCKWISE when looking from the back cover of the motor. An arrow also indicates correct direction of rotation. If direction of rotation is wrong, interchange any of two line wires of the power cable in the terminal box.

9.4 DIFFERENTIAL PRESSURE TRANSMITTER – FUJI

Do not open the cover from the amplifier with active DC power supply in hazardous area.

9.4.1 Zero adjustment of DPT – FUJI

1. Keep the transmitter energised for at least 10 minutes.
2. Remove the covers from the DPT electronics housing.
3. Connect an ammeter to the “CHECK” terminals (+ and -) of the transmitter as shown is drawing **0810-2010**.
4. Check that the “Zero/Span adjustment selector switch” is switched to “ZERO”.
   Refer to the illustrations in drawing **0899-1249**.
5. Apply the lower pressure value.
6. Wait for the pressure to stabilise.
7. Slide away the “ZERO” cover on the DPT electronics housing and adjust the zero point by turning the adjustment screw as shown in drawing **0899-1249**.
   The lower pressure value should then correspond with an output of 4mA.
8. Remove the ammeter and close the covers. Ensure that the sealing ring is installed otherwise the transmitter is not in accordance with IP67.

NOTE:
After adjustment, the transmitter should be kept energized for about 10 seconds to write the adjustment results into the memory.

9.4.2 Span adjustment of DPT – FUJI

1. Keep the transmitter energised for at least 10 minutes.
2. Remove the covers from the DPT electronics housing and read the calibration data plate affixed to the inside of the cover.
3. Connect a suitable pressure gauge and air supply to “+” side of the DPT. Make sure that “-” side vents to atmosphere.
4. Connect an ammeter to the “CHECK” terminals (+ and -) of the transmitter as shown is drawing **0810-2010**.
5. Check that the “Zero/Span adjustment selector switch” is switched to “SPAN”
   Refer to the illustrations in drawing **0899-1249**.
6. Apply pressure shown as “upper calibration value” on calibration data plate of the DPT.
7. Wait for the pressure to stabilise.
8. Slide away the “ZERO” cover on the DPT electronics housing and adjust the output current to 20mA by turning the Zero/Span screw as shown in drawing **0899-1249**.
9. Set the pressure back to the lower pressure value and check that the output is 4mA.
10. After adjusting the span as mentioned above, set the selector switch *back to “Zero” before using the transmitter*.
11. Remove air tools and ammeter and close the covers. Ensure that the sealing ring is installed otherwise the transmitter is not in accordance with IP67.

NOTE:
After adjustment, the transmitter should be kept energized for about 10 seconds to write the adjustment results into the memory.

WARNING:
IN HAZARDOUS ZONES WITH EXPLOSION PROOF REQUIREMENTS THE COVER MUST BE TIGHTENED AT LEAST 7 TURNS.

9.5 DIFFERENTIAL PRESSURE TRANSMITTER – ABB

Do not open the cover from the amplifier with active DC power supply in hazardous ara.

9.5.1 Zero adjustment of DPT – ABB

1. Keep the transmitter energised for at least 10 minutes.
2. Remove the covers from the DPT electronics housing and slide away the tagplate.
3. Connect an ammeter to the “TEST” terminals (ext.meter + and -) of the transmitter as shown is drawing **0810-2010**.
4. Check that the “Write protection switch” is switched to “DISABLED”.
   Refer to the illustrations in drawing **0899-1259**.
5. Apply the lower pressure value.
6. Wait for the pressure to stabilise.
7. Press the “Z” button (under the tagplate on the DPT) for a few seconds as shown in drawing **0899-1259**.
   The lower pressure value should then correspond with an output of 4mA.
8. Remove the ammeter, set the “Write protection switch” to “ENABLED” and close the covers. Ensure that the sealing ring is installed otherwise the transmitter is not in accordance with IP67.

NOTE:
After adjustment, the transmitter should be kept energized for about 10 seconds to write the adjustment results into the memory.

9.5.2 Span adjustment of DPT – ABB

1. Keep the transmitter energised for at least 10 minutes.
2. Remove the covers from the DPT electronics housing, slide away the tagplate and read the calibration data plate affixed to the inside of the cover.
3. Connect a suitable pressure gauge and air supply to “+” side of the DPT. Make sure that “-” side vents to atmosphere.
4. Connect an ammeter to the “TEST” terminals (ext.meter + and -) of the transmitter as shown is drawing **0810-2010**.
5. Check that the “Write protection switch” is switched to “DISABLED”
   Refer to the illustrations in drawing **0899-1259**.
6. Apply pressure shown as “upper calibration value” on calibration data plate of the DPT.
7. Wait for the pressure to stabilise.
8. Press the “S” button (under the tagplate on the DPT) for a few seconds as shown in drawing **0899-1259**.
   The upper pressure value should then correspond with an output of 20mA
9. Set the pressure back to the lower pressure value and check that the output is 4mA.
10. After adjusting the span as mentioned above, set the “Write protection switch” to “ENABLED” and close the tagplate.
11. Remove air tools and ammeter and close the covers. Ensure that the sealing ring is installed otherwise the transmitter is not in accordance with IP67.

NOTE:
After adjustment, the transmitter should be kept energized for about 10 seconds to write the adjustment results into the memory.

WARNING:
IN HAZARDOUS ZONES WITH EXPLOSION PROOF REQUIREMENTS THE COVER MUST BE HAND TIGHTENING AND SECURING WITH THE LOCKING SCREW.

10 TAKE OUT OF SERVICE

The complete installation can be taken out of service by closing the hand valves for the sampling points and dp/I-transmitter and switching off:

- The air supply to the EPU
- The fresh water supply to the skid
- The 24 VDC electrical supply to the MCU
- The 24 VDC electrical emergency supply to the MCU
- The 115/230 VAC electrical supply to the EPU
- The 380 – 420 VAC electrical supply to the sample pump motor

11 REMOVAL AND STORAGE OF EQUIPMENT

To remove and store the ODME the following steps have to be taken:

- Switch off all air-, fresh water- and electrical supplies.
- Make sure that all connections to the skid, EPU and MCU are labelled correctly so that re-installation can be done without any errors.
- Disconnect all the connections in a reverse order as described in section 6.
- Store the different parts of the ODME boxes in a cool and dry location, is such way that the ODME cannot be damaged.

12 MALFUNCTION AND SEND FOR REPAIR

In case of a malfunction, follow the guidelines as described in section 15.
If the ODME cannot be repaired following the guidelines as described in section 15, contact VAF Instruments for instructions.
In the event parts of the ODME have to be sent back for repair, send it directly to:

VAF Instruments B.V.
Vierlinghstraat 24
3316 EL Dordrecht
The Netherlands

13 ENVIRONMENT

The ODME equipment itself has no negative influence on the environment during normal operation. Its use is meant to safeguard the environment for the discharge of excessive oil concentrations.

14 DISPOSAL

The ODME equipment is consists of metal, plastics and electronic parts. It should be disposed according to local laws or regulations.
A green passport can be supplied on request.

15 TROUBLE SHOOTING AND FAULT FINDING

15.1 INTRODUCTION FAULT FINDING GUIDE

The first requirement when attempting to find a fault in the system, is to ensure that the monitor is correctly set up to run. A large number of service problems can be directly related to a simple mechanical fault, which appears to cause a large number of seemingly unrelated problems. It is essential to check before delving too deeply, that all hand-valves in the system are open; that the fresh water supply is available and clean and free of any contaminants; that the air supply to the EPU is on; that electrical supply to the pump is on; and that the electrical supply to the MCU and EPU is on.

It is also important to note that most service problems are mechanical faults and not electronic faults. On the whole, electronic systems are much more reliable than the mechanical components connected to them. However, when a fault occurs, the tendency is to distrust the electronic systems and look for faults in the electronic parts, discounting the mechanical parts. This tendency should be reversed.

The emphasis in this fault finding guide and the following “Repair” section is on mechanical repair and overhaul. Indications are given to assist in electronic repairs, but it is expected that most fault will be rectified by complete board replacement, rather than component replacement. Therefore, it is indicated which board is likely to be the source of the particular problem.

SAFETY PRECAUTIONS: MAKE SURE THAT ALL SAFETY REQUIREMENTS AS DESCRIBED IN SECTION 4.1 ARE MET BEFORE ANY WORK IS COMMENCED.

CAUTION:
The printed circuit boards have CMOS components which may be damaged by electrostatic discharges.
Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic proof cases.

15.2 FAULT FINDING GUIDE

The structure of the following fault finding guide is that the correct functioning path is on the left of the page; the section of the manual for the fault finding is indicated on the right of the page. To use the guide, start at the beginning and take the monitor through the outlined operating procedure, checking that the monitor operates correctly at each point. Should the monitor not operate as specified, refer to the right side of the page and turn to that section of the manual or refer directly to the fault as indicated on the MCU.

If the fault cannot be rectified from this guide, please contact VAF Instruments to request specialist assistance.
Refer to the serial number of the monitor and explain up to which section in this guide the monitor worked correctly.

	Correct Functioning Path	**When Faulty**
1	Turn the switch of the MCU to “Control Unit”. The display of MCU will indicate “STANDBY”.	*Refer to section 15.6*
2	Press the SETUP key to enter the setup mode. Select during SETUP the appropriate sample point and oil type.	*Refer to section 15.4*
3	Press the FLUSH key to enter the FLUSH mode and wait 7 minutes.	*Refer to section 15.4*
4	Air is supplied to the solenoid valves in the EPU. Solenoid V10 and the selected sample valve is energised.	*Refer to section 15.8*
5	The pneumatic shuttle valve on the skid assembly activates. Solenoid V10 together with the selected sample valve in the pump room are opened.	*Refer to section 15.9*
6	The lamp “Running” on the starter box lights up.	*Refer to section 15.11.1*
7	The sample pump starts. The monitor is now in the BACKFLUSH MODE. Fresh water is being pumped from the fresh water inlet, through the sample pump, through the detector cell and via V11 discharged through the sample inlet port of the skid back to the sample probe selected.	*Refer to section 15.11.2*
8	After approximately 2 minutes the FORWARD FLUSH mode is entered and a window wash is performed for 12sec.	*Refer to section 15.4*
9	In the EPU solenoid V11 is energised and solenoid V12 is energised for 12sec.	*Refer to section 15.8*
10	The window wash pump on the skid assembly operates for a few strokes.	*Refer to section 15.10*
11	The pneumatic valve V11 on the skid assembly is now open. The monitor is now in the FORWARD FLUSH MODE. Clean water is pumped from the fresh water inlet through the sample pump, detector cell and then discharge through the sample outlet port into the slop tank/discharge line.	*Refer to section 15.9*

	Correct Functioning Path	**When Faulty**
12	The No Flow alarm is now enabled. Any problem with the fresh water supply will be highlighted at this point.	*Refer to section 15.11.1.2*

13	At this point the calibration is checked. Since the monitor is operating on fresh water, the ZERO ERROR alarm will be activated, if there is any contamination.	*Refer to section 15.3.1*
14	If the windows in the detector cell on the skid assembly are dirty the "PATH DIRTY" alarm will be activated.	*Refer to section 15.3.2*
15	At the end of the flush cycle the sample pump will stop and V10 is released. The display of the MCU will indicate "MODE IDLE".	*Refer to section 15.4*
16	In the EPU all the solenoids including the selected sample point are deactivated. The green lamp "Running" on the Starter Box will turn off and the sample pump will stop.	*Refer to section 15.8*
17	All the pneumatic valves in the system are now in their de-energised position. The system is now in IDLE mode. If required a self test can be performed at this point. This can be done by pressing the SELFTEST key. All recent alarms will be shown.	*Refer to section 15.9*
18	To select the SAMPLE mode press the "Sample" key. The display of the MCU will indicate "MODE SAMPLE". The green lamp "Running" on the starter box will come on. Solenoid V11 and the selected sample valve are energised. The sample pump starts running again.	*Refer to section 15.11*
19	The monitor is now in sample mode and no alarms are activated.	*Refer to section 15.4*
20	After 3 minutes the window wash pump will operate for 3 seconds. The window wash solenoid V12 in the EPU is activated. This action is repeated every 3 minutes.	*Refer to section 15.10*

15.3 CALIBRATION ALARMS

15.3.1 Zero error alarm

	Probable causes	Action
1	Sample pump cavitating	• Check the pressure gauge settings on the Skid Assembly. For correct settings see section 15.11.2
2	Flushing water contaminated	• Check flushing water for oil, dirt or of it contains air. • Check the fresh water tank, if installed. • Drain the fresh water tank and refill the tank, if necessary.
3	Excessive oil left in monitor	• Check the sample outlet of the monitor. Flush the monitor again till the “Zero Error” alarms clears. It is advisable to let the monitor complete the flush cycle each time. This will give the maximum amount of flushing.
4	Transmitter error	• Check the cables from the measurement cell to the junction box on the skid. • Check the cables from the junction box on the skid to the EPU terminal strip. If the alarm persists it is likely that the cell is faulty and will require replacement.

NOTE:
See section 9.1 for the replacement of the measurement cell assembly.

15.3.2 Path dirty alarm

	Probable causes	Action
1	Windows of detector cell dirty	• Operate the window wash pump a few times by pressing [WINDOW WASH] during the flush cycle. This should clean the windows sufficiently to cancel the alarm. If the alarm persists it is necessary to clean the windows in the measurement cell manually as described in section 9.1.
2	Excessive oil in detector cell, “Zero Error” alarm also activated	• Check the sample outlet of the monitor. • Flush the monitor again till the “Zero Error” alarms clears. It is advisable to let the monitor complete the flush cycle each time. This will give the maximum amount of flushing.
3	Transmitter error	• Check the cables from the measurement cell to the junction box on the skid. • Check the cables from the junction box on skid to the EPU terminal strip. If the alarm persists, then it is likely that the cell is faulty and will require replacement. • Also consult section 15.4.5

15.4 SYSTEM ALARMS

15.4.1 No air

Consult section 15.7 and 15.8

15.4.2 No flow

Consult section 15.11.2

15.4.3 Power failures

Consult section 15.6

15.4.4 Communication failure

	Probable causes	Action
1	Communication link not correct	• Check the power to the EPU. • Check the communication link between the MCU and EPU. • Check with a voltmeter on connector X13, terminal 1, 2, 3, 4 of the MCU and connector X1, terminal 5, 6, 8 and 9 in EPU for data transmission. • Term.1/2 or 5/6 for data transmission from MCU • Term.3/4 or 8/9 for data transmission from EPU If the alarm is persistent, please contact VAF Instruments

15.4.5 Led feedback error

	Probable causes	Action
1	Transmitter error	• Check the cables from the measurement cell to the junction box on the skid. • Check the cables from the junction box on skid to the EPU terminal strip. If the alarm persists, it is likely that the cell is faulty and will require replacement.

NOTE:
See section 9.1 for the replacement of the measurement cell assembly.

15.4.6 Flow overrange failure

	Probable causes	Action
1	Overboard discharge flowrate to high.	• Check the overboard discharge flowrate and reduce if necessary.
2	Flowmeter not functioning correct.	• Check the connections of the related flowmeter. • Check the calibration of the related flowmeter. • Also consult section 15.12

15.4.7 Flow underrange failure

	Probable causes	Action
1	Flowmeter not functioning correct	• Check the connections of the related flowmeter. • Check the calibration of the related flowmeter. Also consult section 15.12

15.4.8 Overboard arrangement failure

	Probable causes	Action
1	No power supply	• Check the power supply to the overboard valve actuator. • Check the signal connections between the MCU and the valve actuator.
2	No air supply	• No air supply. • Check the air supply to the overboard valve actuator. • Check the signal connections between the MCU and the valve actuator.
3	Feedback switch failure	• Check the air supply to the overboard valve actuator. • Check the signal connections between the MCU and the valve actuator. • Feedback switch failure. • Check the functioning of the feedback switch. • Check the connections between the MCU and the feedback switch.
4	Overboard valve failure	• Check the functioning of the feedback switch. • Check the connections between the MCU and the feedback switch. • Overboard valve failure. • Check functioning of the overboard valve.

15.4.9 Discharge rate failure

	Probable causes	Action
1	Discharge rate to high.	• Check the overboard discharge rate and reduce it to clear the alarm. Also consult section 7.5

15.4.10 Total discharge oil limit alarm

	Probable causes	Action
1	The maximum oil limit is reached	• STOP the discharge operation immediately. Also consult section 7.5

NOTE:
The maximum amount of oil for this voyage is discharged. the total oil may only be reset at the start of a new ballast voyage.

15.5 GPS PROBLEMS

15.5.1 No GPS signal visible

	Probable causes	Action
1	Wrong GPS settings	Check that GPS setting are: • GPS: NMEA 0183 • Baud rate: 4800 • Data bits: 8 • Parity: none • Stop bits: 1
2	Internal GPS failure	• Disconnect the GPS signal cable from socket X14. • Connect terminals 1 - 3 from socket X14. • Connect terminals 2 - 4 from socket X14. • A GPS NMEA string will be simulated. • If no GPS coordinates are showing there is an internal failure.

15.6 POWER SUPPLY PROBLEMS

15.6.1 MCU Power failure

	Probable causes	Action
1	24 VDC power failure	• Check if the isolator for the single phase supply is ON. • Check if the power to the MCU is switched ON.
2	Emergency power failure	• Check if the emergency power is switched ON.

15.6.2 Electro Pneumatic Unit power failure

	Probable causes	Action
1	Single phase power failure.	• Check if the isolator for the single phase supply is ON. • Check the fuse inside the cover of the EPU, fuse 1 AF (fast).
2	Power supply unit failure.	• Check the power supply unit in the EPU. • Check the fuse of the power supply unit in the EPU.

NOTE:
To check the fuse, remove the front panel from the EPU. The fuse is located on the back face of the front panel. if problems remain the power supply should be replaced with a spare one and shipped to VAF Instruments for repair.

15.7 AIR SUPPLY PROBLEMS

15.7.1 Air supply failure

	Probable causes	Action
1	No air supply	• Check the air supply to the EPU, normally set to 4.0 bar (0.4 MPa). • Check the ship's control air supply. • Check all connections for leakage.
2	Pressure sensor failure	• Check the connections to the pressure sensor on the solenoid valve block on the EPU assembly. • Check the functioning of the pressure sensor with a digital voltmeter for open/closed circuit function.

15.7.2 Water found in the monitors of the air system

	Probable causes	Action
1	Water in air supply unit housing.	• Check the air supply unit regulator and drain if necessary. If a great deal of water is found the filters in the regulators need to be replaced.
2	Malfunction in ship's control air system.	• Check the ship's compressors. • Check the ship's air dryers.

15.8 SOLENOID VALVE PROBLEMS

15.8.1 Valve not working

	Probable causes	Action
1	No air supply	• Check the air supply unit regulator, normally set to 4.0 bar (0.4 MPa). • Check the ship's control air supply. • Check all connections for leakage.
2	24 V power supply failure	• Check the 24 V power supply. • Check the fuse of the power supply. • Check the connections to the solenoid valve.
3	Solenoid valve actuator not functioning	• Check the solenoid valve connections. • Change the plug on the faulty solenoid, for the plug from a solenoid that is known to be working. Replace if necessary.
4	Solenoid air valve not working	• Check the air valve for dirt, water or other contamination. Replace if necessary.

15.9 PNEUMATIC VALVE PROBLEMS

For repair procedures of pneumatic valves consult section 8.2.5.

15.9.1 Valve not functioning

	Probable causes	Action

1	No air supply	• Check the air supply unit regulator in the air supply line to the valve, normally set to 4.0 bar (0.4 MPa). • Check all air connections for leakage. • Check the ship's control air system. • Check the functioning of the solenoid valve. See section 15.8.
2	Pneumatic valve failure	• Check the actuator housing for leakage.

15.9.2 Valve gland leakage

	Probable causes	**Action**
1	Worn gaskets	• Damaged or worn gaskets or damage of the valve gland. Replacement of the gaskets is required. The unit should be returned to a qualified service centre for repair.

15.9.3 Valve leakage

	Probable causes	**Action**
1	Leakage between the valve plug and seat	• Damaged or worn valve seat and plug. Replacement of the valve seat and plug is required. The unit should be returned to a qualified service centre for repair.

15.10 WINDOW WASH PUMP PROBLEMS

For disassembly and re-assembly procedures of the window wash pump consult section 8.2.4.

15.10.1 Pump does not work

	Probable causes	Action
1	Air supply failure	• Check the air supply to solenoid V12 in the EPU, minimum 5.0 bar (0.5 MPa). • Check the air supply to the regulator/lubricator, minimum 5.0 bar (0.5 MPa). • Check the functioning of solenoid V12 in the EPU.
2	Air cycle valve failure	• Check the sleeve and cycling spool (under the cap of the muffler) for contamination. Replace if necessary.
3	Electric circuit failure	• Check the power supply in the EPU. • Check the connection to solenoid V12 in the EPU. • Check the operation of solenoid V12. Replace if necessary. • Check the connection between the MCU and the EPU.

15.10.2 Pump cycles without pumping or does not stall

	Probable causes	Action
1	No water supply.	• Check the water supply to the pump.
2	Check valves not seating or leaking in the system.	• Inspect the inlet check valve. • Inspect the outlet check valve.

15.10.3 False cycle

	Probable causes	Action
1	Leakage from the pilot exhaust (top centre of the cap).	• Check the air section seal. Replace if necessary.

15.10.4 Fluid appears at muffler

	Probable causes	Action
1	High pressure seal leakage.	• Check the high pressure seal. Replace if necessary.

15.11 SAMPLE PUMP PROBLEMS

15.11.1 Electrical problems

15.11.1.1 Pump runs but the green indicator on the starter box is off

	Probable causes	Action
1	Indicator failure.	• Check power supply to indicator lamp. • Check indicator lamp.

15.11.1.2 Pump should be running but is off

	Probable causes	Action
1	3-phase power supply failure.	• Check if the 3-phase power supply is switched on. • Check the fuses of the 3-phase power supply. the water supply to the pump.
2	Thermal trip of the pump.	• Check the terminal trip on the pump contactor in the starter box. The red light is ON. Reset if necessary.
3	Pump contactor failure.	• Check the power on the contactor terminals (1,2), these should be 24 VDC. Also check also for correct polarity. • Check the 24 VDC power supply in the EPU. • Check the connections between the starter box and the EPU.

NOTE:
If the motor repeatedly trips out on thermal trip, check the motor and pump for binding or blockages etc. do not force the motor to run.

15.11.2 Pump related problems

NOTE:
During forward flush and in sample mode, normal operating conditions are:

- Pump discharge pressure 5 to 8 bar. (0.5 to 0.8 MPa).
- Pump suction pressure 0 to 1 bar. (0 to 0.1 MPa).

(Pressures may vary from one installation to another)

15.11.2.1 No flow

	Probable causes	Action
1	No fresh water supply. (low discharge pressure < 2 bar during flushing). (< 0.2 MPa during flushing).	• Check if the 3-phase power supply is switched on. • Check the fuses of the 3-phase power supply. the water supply to the pump.
2	No sample water supply. (low discharge pressure < 2 bar during sampling). (< 0.2 MPa during sampling).	• Check if the cargo/stripping pump is ON. • Check if the discharge line is filled with water. • Check if the manual valve of the sample probe is open. • Check if the pneumatic valve in the sample line is open. • Check if the manual valve in the sample inlet of the skid assembly is open.
3	Blockage in outlet line. (high discharge pressure > 10 bar). (>1 MPa).	• Check if the manual valve in the sample outlet of the skid assembly is open. • Check if the manual valve on the discharge to the slop tank is open.
4	Flowrate through the monitor too low	• Check the flowrate through the monitor. • Read the skid flow from the display during FORWARD FLUSH or SMAPLE mode and ensure the flow is between 450 - 550 l/h. • The flowrate can be adjusted by means of the needle valve on the outlet of measurement cell.
5	Malfunction of the flow sensor.	• Check the electrical connections on the flow sensor. • Check the connections between the flow sensor and the EPU. • Check the function of the flow sensor.

NOTE:
During commissioning the flowrate through the monitor is set to between 450 and 550 l/hour. The “no-flow” alarm is activated at flows less than 240 litres per hour.

NOTE:
During back flush, the “no flow” alarm is inhibited. The flow alarm comes into operation at the start of the forward flush cycle.

15.12 DIFFERENTIAL PRESSURE TRANSMITTER PROBLEMS

NOTE:
For disassemble and re-assemble instructions consult section 8.2.7.

15.12.1 No line current

	Probable causes	Action
1	Transmitter connections.	- Check the wiring polarity and continuity. - Check for shorts or ground loops. - Check if the power supply connector is connected to the main board.
2	Power supply.	- Check the power supply output. The voltage must be between 12 and 45 VDC at the transmitter terminals.
3	Electronic circuit failure.	- Check the main board for defects by replacing it with a spare one.

15.12.2 Current of 21.0mA or 3.9mA

	Probable causes	Action
1	Pressure tap (piping).	• Verify if the blocking valves are fully open. • Check for gas in the liquid lines. • Check the specific density of the process fluid. • Check the process flanges for sediments. • Check the pressure connection. • Check if the bypass valve is closed. • Check if the pressure applied is not over the upper limit of the DPT range.
2	Sensor to the main circuit connection.	• Check all connections (male and female connectors).
3	Electronic circuit failure.	• Check the sensor circuit for defects by replacing it with a spare one. Replace if necessary.

15.12.3 Incorrect output

	Probable causes	Action
1	Transmitter connections.	• Check the power supply voltage • Check for intermittent short circuits, open circuits and grounding problems.
2	Noise measurement fluid.	• Adjust damping.
3	Pressure tap.	• Check for gas in the liquid lines. • Check the integrity of the circuit by replacing it with a spare one.
4	Calibration.	• Check the calibration of the dP transmitter.

15.13 FAULT FINDING FORM

In case the fault finding guide does not result in a proper working of the system, the fault finding form can be used. This form should be filled in and returned to VAF Instruments Service department. The form is included in this technical manual 641.

OIL DISCHARGE MONITOIRNG & CONTROL SYSTEM

FAULT FINDING FORM

Fault Finding Aid Checklist Oilcon® Mark 6M

Serial number MCU: ……
(the serial number can be found on the backside, 6 digits)

Serial number EPU: ……
(Stamped on the Ex ia type plate at the left side of the EPU, 6 digits)

At the DATA ENTRY PARAMETERS printout you will find the K-Factor parameters:

Skid K-Factor: ……p/l

Cell K-Factor: ……

The following steps have to be followed in order for VAF Instruments to determine if the ODM system is having a malfunction. If during the complete procedure an alarm is triggered, push the Alarm rest button and write down the Alarm.

Step	Description	Action	
1	Make sure the EPU in the engine room is switched ON.		
2	Reset the MCU by pushing the Reset button.		
3	Turn the key switch of the MCU to Control Mode.		
4	Wait for 1 minute and write down any alarm which comes up. Acknowledge the alarm by pressing “ACK” and wait again for one minute. (Inform VAF if any alarm comes up.)		
5	Go through the configuration menu of the MCU.		
6	Source for ship’s speed (GPS/Speed log).	Set to:	Ship’s log
7	Go through the setup menu of the MCU and write down the input.		
8	Sample point.	Write down	
9	Total oil limit.	Write down	
10	Reset total oil.	Set to:	Yes
11	Discharge alarm.	Set to:	30 l/NM
12	Speed indication.	Set to:	Auto
13	Flow rate indication.	Set to:	Auto
14	Oil type.	Write down	
15	Concentration alarm.	Set to:	1000 ppm
16	Printing interval.	Set to:	10 min
17	Oil concentration indication.	Set to:	Auto
18	Date and time.		
19	Press the Flush key to go into flush mode.		
20	Check if the pump is running now.		
21	Wait until system comes in Idle mode.		
22	Push the ? Key. Active alarms will be shown.	Write down	
23	After print out the MCU will go back to Idle mode.		
24	Push the Stop key.		
25	The system will go to Stand-by.		
26	Turn the key switch to OFF.		

List of alarms which were triggered during the above procedure:

: .....

: .....

: .....

: .....

: .....

: .....

: .....

: .....

VAF INSTRUMENTS

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3300 AA Dordrecht
The Netherlands

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Website: www.vaf.nl
E-mail: sales@vaf.nl

16 CERTIFICATES

16.1 CERTIFICATES OF EX-PROOF

Certificate	Type	For
KEMA	EC-type examination	Oil Discharge Monitor Type Oilcon® Mark 6M
KEMA	EC Declaration of Conformity for Equipment and Protective Systems	Oil Discharge Monitor Type Oilcon® Mark 6M Which consists of EPU-interface and Detector Cell
KEMA	EC-type examination certificate	Electronic Pressure Transmitter – dP/I (overboard discharge flowmeter)
IEC	IECEx Certificate of Conformity	Oil Discharge Monitor type Oilcon Mark 6M
PTB	EC-type examination certificate	Cylindrical Inductive sensor (skid flowmeter)

CERTIFICATE

(1) EC-Type Examination

(2) **Equipment and protective systems intended for use in potentially explosive atmospheres - Directive 94/9/EC**

(3) EC-Type Examination Certificate Number: **KEMA 03ATEX1187 X** Issue Number: **3**

(4) Equipment: **Oil Discharge Monitor Type Oilcon Mark 6M**

(5) Manufacturer: **VAF Instruments B.V.**

(6) Address: **Vierlinghstraat 24, 3316 EL Dordrecht, The Netherlands**

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) DEKRA Certification B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the directive.

The examination and test results are recorded in confidential test report number 211995100.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0 : 2009 **EN 60079-11 : 2012** **EN 60079-26 : 2007**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment according to the Directive 94/9/EC. Further requirements of the directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

II (1) G [Ex ia Ga] IIB
II 1 G Ex ia IIB T4 Ga

This certificate is issued on 16 July 2012 and, as far as applicable, shall be revised before the date of cessation of presumption of conformity of (one of) the standards mentioned above as communicated in the Official Journal of the European Union.

DEKRA Certification B.V.

C.G. van Es
Certification Manager

PRODUCTS RvA C 091

All testing, inspection, auditing and certification activities of the former KEMA Quality are an integral part of the DEKRA Certification Group

DEKRA Certification B.V. Utrechtseweg 310, 6812 AR Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 26 3 56 20 00 F +31 26 3 52 58 00 www.dekra-certification.com Registered Arnhem 09085396

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 03ATEX1187 X** Issue No. 3

(15) **Description**

Oil Discharge Monitor Type Oilcon Mark 6M with Detector cell is used for on-line monitoring of discharge water during deballasting operations. The monitor provides intrinsically safe circuits for the measurement of the process flow and for the detection of oil in the ballast water with the necessary intrinsically safe Detection cell. The monitor provides control and output signals to several components of the monitoring system.

The Detector cell is provided with a permanently connected cable.

Ambient temperature range -40 °C to +60 °C.

Electrical data

Non-intrinsically safe circuits

Supply:	115 V ac or 230 V ac, 0,5 W
Control circuits (relays):	24 V dc, max. 10 W
Communication circuits (e.g. RS 422):	19 V dc, 20 mW U_m = 250 V ac

Intrinsically safe circuits

Flow sensor input (terminals 13 and 14):
in type of protection intrinsic safety Ex ia IIB, with the following maximum values:
U_o = 14 V; I_o = 20 mA; P_o = 70 mW; C_o = 4,6 µF; L_o = 350 mH.

Pressure sensor inputs (terminals 15, 16 and 17, 18):
in type of protection intrinsic safety Ex ia IIB, with the following maximum values:
U_o = 21 V; I_o = 82 mA; P_o = 430 mW; C_o = 1,23 µF; L_o = 20 mH.

Detector input (terminals 1 ... 12):
in type of protection intrinsic safety Ex ia IIB, only for connection to the intrinsically safe Detector cell, via a cable with following maximum values:
C_c = 0,2 µF; L_c = 0,1 mH; L_c/R_c = 46 µH/Ω.

From the safety point of view, the intrinsically safe circuits shall be considered to be connected to earth. The circuits of the Detector cell withstand a test voltage of at least 500 V during 1 minute with respect to the enclosure.

Installation instructions

The instructions provided with the equipment shall be followed in detail to assure safe operation.

(16) **Test Report**

No. 211995100.

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 03ATEX1187 X** Issue No. 3

(17) **Special conditions for safe use**

The Discharge monitor shall be connected to the potential equalising system, using the dedicated earth terminal, taking into account the local installation code of practice.

The intrinsically safe detector circuits, if connected in a junction box, shall be connected such, that the separation between these circuits and all other circuits present, meets the requirements of the applicable installation standards. The junction box shall be suitable for the environmental conditions in order to assure the integrity of the separations.

For ambient temperature range and electrical data, refer to (15).

(18) **Essential Health and Safety Requirements**

Covered by the standards listed at (9).

(19) **Test documentation**

As listed in Test Report No. 211995100.

English IIA

EU DECLARATION OF CONFORMITY FOR EQUIPMENT and PROTECTIVE SYSTEMS for use in explosive atmospheres

(Directive 2014/34/EU)

We

Manufacturer:	**VAF Instruments BV**
Adress:	**Vierlingstraat 24** **3316 EL Dordrecht** **The Netherlands**
Notified Body:	**DEKRA Certification B.V. (0344)**
Adress:	**Meander 1051** **6825 MJ Arnhem** **The Netherlands**

herewith declare that:

Oil Discharge Monitor Type Oilcon® Mark 6M:
Which consists of ElectroPneumatic Unit 0399-0383,
and Detector Cell 0301-0589
is in conformity with the provisions of the EC directive 2014/34/EU.

The following standards were applied:

EN 60079-0 :2009
EN 60079-11:2012
EN 60079-26:2007

Marking: **II (1) G [Ex ia] IIB KEMA 03ATEX1187 X CE (interface)**
II 1 G Ex ia IIb T4 KEMA 03ATEX1187 X CE (detector cell)

Dordrecht,
25 April 2016

M. van Beveren
Quality Manager

Form Q-019B

CERTIFICATE

(1) EU-Type Examination

(2) **Equipment or protective systems intended for use in potentially explosive atmospheres - Directive 2014/34/EU**

(3) EU-Type Examination Certificate Number: **DEKRA 13ATEX0222 X** Issue Number: **2**

(4) Product: **Electronic Pressure Transmitters Type FCX-AIII or FCX-AII**

(5) Manufacturer: **Fuji Electric Co., Ltd.**

(6) Address: **1, Fuji-machi, Hino-City, Tokyo 191-8502, JAPAN**

(7) This product and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) DEKRA Certification B.V., Notified Body number 0344 in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this product has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of products intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential test report number 216829300, issue 2.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0 + A11 : 2013 **EN 60079-11 : 2012**

except in respect of those requirements listed at item 18 of the Schedule.

(10) If the sign "X" is placed after the certificate number, it indicates that the product is subject to the Specific Conditions of Use specified in the schedule to this certificate.

(11) This EU-Type Examination Certificate relates only to the design and construction of the specified product. Further requirements of the Directive apply to the manufacturing process and supply of this product. These are not covered by this certificate.

(12) The marking of the product shall include the following:

II 1 G Ex ia IIC T4 / T5 Ga
II 1 D Ex ia IIIC T100 °C / T135 °C Da

Date of certification: 6 July 2018

DEKRA Certification B.V.

R. Schuller
Certification Manager

DEKRA Certification B.V. Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
T +31 88 96 83000 F +31 88 96 83100 www.dekra-certification.com Registered Arnhem 09085396

(13) **SCHEDULE**

(14) to EU-Type Examination Certificate DEKRA 13ATEX0222 X Issue No. 2

(15) **Description**

Electronic Pressure Transmitters Type FCX-AIII or FCX-AII are used to measure the differential, absolute or relative pressure of a liquid or a gas. The measurement signal is converted into a digital signal. Different versions are available: 4-20mA, Foundation Fiedbus / FISCO and SIL. Optionally, the transmitter is provided with a digital or analog display.

The enclosure of the transmitter provides a degree of ingress protection of at least IP66 in accordance with EN 60529.

Ambient temperature ranges:
For 4-20mA/HART models and also for SIL option:
Ex ia IIC T4 Ga; T_a = -40 °C to +70 °C
Ex ia IIC T5 Ga; T_a = -40 °C to +50 °C
Ex ia IIIC T135 °C Da; T_a = -40 °C to +70 °C
Ex ia IIIC T100 °C Da; T_a = -40 °C to +50 °C

For Fieldbus Foundation:
Ex ia IIC T4 Ga; T_a = -40 °C to +60 °C
Ex ia IIIC T135 °C Da; T_a = -40 °C to +60 °C

Electrical data

Supply and output signal 4-20mA/ HART versions;	In type of protection intrinsic safety Ex ia IIC, only for connection to a certified intrinsically safe circuit, with following maximum values: U_i = 28 Vdc I_i = 94,3 mA P_i = 660 mW L_i = 0,6 / 0,7 mH for models with/without Analog Indicator C_i = 26 / 36 nF for models with/without Arrester Board
Supply and output signal Foundation Fieldbus	In type of protection intrinsic safety Ex ia IIC, only for connection to a certified intrinsically safe circuit, with following maximum values: U_i = 24 Vdc I_i = 250 mA P_i = 1,2 W L_i = 9,87 µH for models with/without Analog Indicator C_i = 4,04 nF for models with/without Arrester Board or FISCO parameters: U_i = 17,5 V I_i = 380 mA P_i = 5,32 W C_i = 4,04 nF L_i = 9,87 µH

(13) **SCHEDULE**

(14) to EU-Type Examination Certificate DEKRA 13ATEX0222 X Issue No. 2

Supply and output signal SIL versions	In type of protection intrinsic safety Ex ia IIC, only for connection to a certified intrinsically safe circuit, with following maximum values: U_i = 28 Vdc I_i = 110 mA P_i = 770 mW L_i = 0,7 / 0,6 mH for models with/without Analog Indicator C_i = 39 / 26 nF for models with/without Arrester Board

Installation instructions

The instructions provided with the product shall be followed in detail to assure safe operation.

(16) **Report Number**

No. 216829300, issue 2.

(17) **Specific conditions of use**

Measured process pressure and process temperature are limited for each specific installation in order to assure that the design ratings are not exceeded in any application. The application process temperature in conjunction with ambient temperature of the application does not elevate the temperature inside the enclosure above the maximum ambient temperature rated for the transmitter which is 70 °C for temperature code T4 and 50 °C for temperature code T5.

Suitable rated cable glands or plugs shall be used to assure IP66/IP67 rating of the final installation.

Installations for models incorporating the Arrester Board shall consider that these models do not assure electrical insulation of minimum 500Vac between the input circuitry and enclosure.

In case of Ga application, sufficient actions shall be taken to avoid, even in case of rare fault, an ignition hazard due to impact or friction.

(18) **Essential Health and Safety Requirements**

Covered by the standards listed at item (9).

(19) **Test documentation**

As listed in Report No. 216829300, issue 2.

(20) **Certificate history**

Issue 0 -	216826100	initial certificate
Issue 1 -	222308300	added new Foundation Fieldbus / FISCO versions and SIL versions; Assessed in accordance with latest edition of the standard; EN 60079-26 removed.

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx DEK 12.0043X	issue No.:0	Certificate history:
Status:	**Current**		
Date of Issue:	**2012-07-16**	Page 1 of 3	

Applicant: **VAF Instruments B.V.**
Vierlinghstraat 24
3316 EL Dordrecht
The Netherlands

Electrical Apparatus: **Oil Discharge Monitor Type Oilcon Mark 6M**
Optional accessory:

Type of Protection: **ia**

Marking: [Ex ia Ga] IIB
Ex ia IIB T4 Ga

Approved for issue on behalf of the IECEx Certification Body: C.G. van Es

Position: Certification Manager

Signature:
(for printed version)

Date: 2012-07-16

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

DEKRA Certification B.V.
Utrechtseweg 310
6812 AR Arnhem
The Netherlands

All testing, inspection, auditing and certification activities of the former KEMA Quality are an integral part of the DEKRA Certification Group.

DEKRA

IECEx Certificate of Conformity

Certificate No.: IECEx DEK 12.0043X

Date of Issue: **2012-07-16** Issue No.: **0**

Manufacturer: **VAF Instruments B.V.**
Vierlinghstraat 24
3316 EL Dordrecht
The Netherlands

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2011 Edition: 6.0	Explosive atmospheres - Part 0: General requirements
IEC 60079-11 : 2011-06 Edition: 6.0	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
IEC 60079-26 : 2006 Edition: 2	Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:
NL/DEK/ExTR12.0044/00

Quality Assessment Report:

NL/DEK/QAR11.0044/00

IECEx Certificate of Conformity

Certificate No.: IECEx DEK 12.0043X

Date of Issue: **2012-07-16** Issue No.: **0**

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

Oil Discharge Monitor Type Oilcon Mark 6M with Detector cell is used for on-line monitoring of discharge water during deballasting operations. The monitor provides intrinsically safe circuits for the measurement of the process flow and for the detection of oil in the ballast water with the necessary intrinsically safe Detection cell. The monitor provides control and output signals to several components of the monitoring system.

The Detector cell is provided with a permanently connected cable.

Ambient temperature range -40 °C to +60 °C.

Electrical data

Non-intrinsically safe circuits

Supply: 115 V ac or 230 V ac, 0.5 W
Control circuits (relays): 24 V dc, max. 10 W
Communication circuits (e.g. RS 422): 19 V dc, 20 mW
Um = 250 V ac

Intrinsically safe circuits

Flow sensor input (terminals 13 and 14):
in type of protection intrinsic safety Ex ia IIB, with the following maximum values:
Uo = 14 V; Io = 20 mA; Po = 70 mW; Co = 4.6 µF; Lo = 350 mH.

Pressure sensor inputs (terminals 15, 16 and 17, 18):
in type of protection intrinsic safety Ex ia IIB, with the following maximum values:
Uo = 21 V; Io = 82 mA; Po = 430 mW; Co = 1.23 µF; Lo = 20 mH.

Detector input (terminals 1 ... 12):
in type of protection intrinsic safety Ex ia IIB, only for connection to the intrinsically safe Detector cell, via a cable with following maximum values:
Cc = 0.2 µF; Lc = 0.1 mH; Lc/Rc = 46 µH/Ω.

From the safety point of view, the intrinsically safe circuits shall be considered to be connected to earth. The circuits of the Detector cell withstand a test voltage of at least 500 V during 1 minute with respect to the enclosure.

CONDITIONS OF CERTIFICATION: YES as shown below:

The Discharge monitor shall be connected to the potential equalising system, using the dedicated earth terminal, taking into account the local installation code of practice.

The intrinsically safe detector circuits, if connected in a junction box, shall be connected such, that the separation between these circuits and all other circuits present, meets the requirements of the applicable installation standards. The junction box shall be suitable for the environmental conditions in order to assure the integrity of the separations.

For ambient temperature range and electrical data, refer above

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

(1) **EC-TYPE-EXAMINATION CERTIFICATE**

(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 00 ATEX 2048 X

(4) Equipment: Cylindrical inductive sensors, types NC... and NJ...

(5) Manufacturer: Pepperl + Fuchs GmbH

(6) Address: D-68307 Mannheim

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 00-29206.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 **EN 50020:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:

Ⓔx II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, September 26, 2000

(13) # SCHEDULE

(14) ## EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

(15) Description of equipment

The cylindrical inductive sensors, types NC... and NJ...are used to convert displacements into electrical signals.

The cylindrical inductive sensors may be operated with intrinsically safe circuits certified for categories and explosion groups [EEx ia] IIC or IIB resp. [EEx ib] IIC or IIB. The category as well as the explosion group of the intrinsically safe cylindrical inductive sensors depends on the connected supplying intrinsically safe circuit.

Electrical data

Evaluation and
supply circuit..... type of protection Intrinsic Safety EEx ia IIC/IIB
resp. EEx ib IIC/IIB
only for connection to certified intrinsically safe circuits
maximum values:

type 1	type 2	type 3	type 4
U_i = 16 V	U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA	I_i = 76 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW	P_i = 242 mW

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors is shown in the following table:

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

types	C_i	L_i	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[µH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
NCB1,5...M...N0...	90	100	74	89	100	69	84	100	51	66	85	39	54	67
NCB2-12GK...-N0...	90	100	73	88	100	69	84	100	51	66	80	39	54	61
NCB2-12GM...-N0...	90	100	76	91	100	73	88	100	62	77	81	54	63	63
NCN4-12GK...-N0...	95	100	73	88	100	69	84	100	51	66	80	39	54	61
NCN4-12GM...-N0...	95	100	76	91	100	73	88	100	62	77	81	54	63	63
NCB5-18GK...-N0...	95	100	73	88	100	69	84	100	51	66	80	39	54	61
NCB5-18GM...-N0...	95	100	76	91	100	73	88	100	62	77	81	54	63	63
NCN8-18GK...-N0...	95	100	73	88	100	69	84	100	51	66	80	39	54	61
NCN8-18GM...-N0...	95	100	76	91	100	73	88	100	62	77	81	54	63	63
NCB10-30GK..-N0...	105	100	73	88	100	69	84	100	51	66	80	39	54	61
NCB10-30GM..-N0...	105	100	76	91	100	73	88	100	62	77	81	54	63	63
NCN15-30GK...-N0...	110	100	73	88	100	69	84	100	51	66	80	39	54	61
NCN15-30GM...-N0...	110	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 0,2-10GM-N...	20	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 0,8-4,5-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 0,8-5GM-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-6,5...-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-10GM-N-Y...	20	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-8GM-N...	30	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-8-N...	20	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 1,5-18GM-N-D...	50	60	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-11-N...	45	50	73	88	100	66	81	100	45	60	89	30	45	74
NJ 2-11-N-G...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-12GK-N...	45	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 2-12GM-N...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2-14GM-N...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 2,5-14GM-N...	30	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 4-12GK-N...	45	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 4-14GK-N...	45	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 4-12GM-N...	45	50	73	88	100	68	83	100	49	64	67	36	42	42
NJ 4-30GM-N-200...	70	100	73	88	100	66	81	100	45	60	89	30	45	74
NJ 5-10-11-N...	70	100	73	88	100	66	81	100	45	60	78	30	45	57
NJ 5-11-N...	45	50	72	87	100	65	80	100	42	57	82	26	41	63
NJ 5-18GK-N...	70	50	73	88	100	69	84	100	51	66	80	39	54	61
NJ 5-18GM-N...	70	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 6-22-N...	130	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 8-18GK-N...	70	50	73	88	100	69	84	100	51	66	80	39	54	61

types	C_i	L_i	type 1			type 2			type 3			type 4		
			maximum permissible ambient temperature in °C for application in temperature class											
	[nF]	[µH]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
NJ 8-18GM-N...	70	50	76	91	100	73	88	100	62	77	81	54	63	63
NJ 10-22-N...	130	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 10-30GK...-N...	140	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 10-30GM-N...	140	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 15-30GK...-N...	140	100	73	88	100	69	84	100	51	66	80	39	54	61
NJ 15-30GM-N...	140	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 25-50-N...	150	140	73	88	100	69	84	100	51	66	80	39	54	61
NJ 20-40-N...	140	140	73	88	100	69	84	100	51	66	80	39	54	61

(16) Test report PTB Ex 00-29206

(17) Special conditions for safe use

1. For the application within a temperature range of -60 °C to -20 °C the cylindrical inductive sensors, types NC... and NJ... must be protected against damage due to impact by mounting into an additional housing.
2. The connection facilities of the cylindrical inductive sensors, types NC... and NJ... shall be installed as such that at least a degree of protection of IP20 according to IEC-publication 60529:1989 is met.
3. The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors is shown in the table given under item (15) of this EC-type-examination certifcate.
4. Inadmissible electrostatic charge of parts of the metal housing has to be avoided for the following types of cylindrical inductive sensors. Dangerous electrostatic charges of parts of the metal housing can be avoided by grounding of these parts whereas very small parts of the metal housing (e.g. screws) don't need to be grounded:

NCB1,5...M...N0...	NJ 1,5-6,5...-N...	NJ 4-30GM-N-200...
NCB2-12GM...-N0...	NJ 1,5-10GM-N-Y...	NJ 5-11-N-545...
NCN4-12GM...-N0...	NJ 1,5-8GM-N...	NJ 5-11-N-G...
NCB5-18GM...-N0...	NJ 1,5-8-N...	NJ 5-18GM-N...
NCN8-18GM...-N0...	NJ 1,5-18GM-N-D...	NJ 6-22-N-G...

NCB10-30GM..-N0...	NJ 2-11-N-G...	NJ 8-18GM-N...
NCN15-30GM...-N0...	NJ 2-12GM-N...	NJ 10-22-N-G...
NJ 0,2-10GM-N...	NJ 2-14GM-N...	NJ 10-30GM-N...
NJ 0,8-4,5-N...	NJ 2,5-14GM-N...	
NJ 0,8-5GM-N...	NJ 4-12GM-N...	

(18) Essential health and safety requirements

Met by the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, September 26, 2000

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

6. SUPPLEMENT

according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

(Translation)

Equipment: Cylindrical inductive sensors, types NC... and NJ...

Marking: **II 1 G Ex ia IIC T6...T1 Ga or II 2 G Ex ia IIC T6...T1 Gb**

Manufacturer: Pepperl+Fuchs GmbH

Address: Lilienthalstraße 200
68307 Mannheim, Germany

Description of supplements and modifications

In the future the cylindrical inductive sensors, types NC... and NJ... may also be manufactured and operated as described in the test documents listed in the test report PTB Ex 15-25162

The modifications concern the application of the new state of the standard EN 60079-0, the extension of the EC-type examination certificate by type of protection Ex ia IIIC for the cylindrical inductive sensors, types NC... and NJ... as well as the application of further casting resin systems intended for casting the cylindrical inductive sensors.

Resulting from this – the marking, the "Electrical Data" as well as the "Special Conditions" for the cylindrical inductive sensors, types NC... and NJ... change.

In the future the marking will read:

II 1 G Ex ia IIC T6... T1 Ga or II 2 G Ex ia IIC T6...T1 Gb

resp.

II 1 D Ex ia IIIC T135°C Da or II 2 D Ex ib IIIC T135°C Db

ZSEx10101e b

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

Electrical data

Evaluation and supply circuit..... only for connection to certified intrinsically safe circuits

Ex ia IIC/IIB for EPL Ga
or Ex ia IIIC for EPL Da
or Ex ia IIC/IIB or Ex ib IIC/IIB for EPL Gb
or Ex ia IIIC or Ex ib IIIC for EPL Db

Maximum values:

type 1	type 2	type 3	type 4
U_i = 16 V	U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA	I_i = 76 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW	P_i = 242 mW

Table 1

ZSEx10101e b

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

For relationship between type of connected circuit, maximum ambient temperature in °C for the application as EPL-Ga equipment and temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors, reference is made to the following Table 2:

Type	C_i [nF]	L_i [µH]	Type 1					Type 2					Type 3					Type 4				
			T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1
NCB1,5-...M...N0...	90	100	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	62	62	62
NCB2-12GM...-N0...	90	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NCB4-12GM...-N0...	120	50	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	52	52	52
NCN4-12GM...-N0...	95	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NCB5-18GM...-N0...	95	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NCB8-18GM...-N0...	120	50	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	52	52	52
NCN8-18GM...-N0...	95	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NCB10-30GM...-N0...	105	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NCB15-30GM...-N0...	120	150	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	52	52	52
NCN15-30GM...-N0...	110	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 0,8-5GM-N...	30	50	56	68	96	96	96	51	63	91	91	91	32	44	67	67	67	19	31	41	41	41
NJ 1,5-6,5...-N...	30	50	56	68	96	96	96	51	63	91	91	91	32	44	67	67	67	19	31	41	41	41
NJ 1,5-8GM-N...	30	50	56	68	96	96	96	51	63	91	91	91	32	44	67	67	67	19	31	41	41	41
NJ 1,5-10GM-N-Y...	20	50	56	68	96	96	96	51	63	91	91	91	32	44	67	67	67	19	31	41	41	41
NJ 1,5-18GM-N-D...	50	60	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 2-11-N...	45	50	55	67	95	95	95	49	61	89	89	89	28	40	68	68	68	13	25	53	53	53
NJ 2-11-N-G...	30	50	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 2-12GM-N...	30	50	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 4-30GM-N-200... (oscillator unit)	70	100	56	68	96	148	192	49	61	89	141	186	28	40	68	120	164	13	25	53	105	149
NJ 4-30GM-N-200... (amplifier unit)	70	100	56	68	96	96	96	49	61	89	89	89	28	40	68	68	68	13	25	53	53	53
NJ 4-12GM-N...	45	50	56	68	96	96	96	51	63	91	91	91	32	44	67	67	67	19	31	41	41	41
NJ 5-18GM-N...	70	50	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 5-18GK-N...	70	50	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	61	61	61
NJ 5-18GK-N-150...	70	50	57	69	97	149	150	52	64	92	144	150	34	46	74	126	150	22	34	61	114	136
NJ 8-18GK-N...	70	50	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	61	61	61
NJ 8-18GK-N-150...	70	50	57	69	97	149	150	52	64	92	144	150	34	46	74	126	150	22	34	61	114	136
NJ 8-18GM-N...	70	50	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 10-30GM-N...	140	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63
NJ 15-30GK-N...	140	100	57	69	97	97	97	52	64	92	92	92	34	46	74	74	74	22	34	61	61	61
NJ 15-30GK-N-150...	140	100	57	69	97	149	150	52	64	92	144	150	34	46	74	126	150	22	34	61	114	136
NJ 15-30GM-N...	140	100	59	71	99	99	99	56	68	96	96	96	45	57	81	81	81	37	49	63	63	63

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

For relationship between type of connected circuit, maximum ambient temperature in °C for the application as EPL-Gb equipment and temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors, reference is made to the following Table 3:

Type	C_i [nF]	L_i [µH]	Type 1					Type 2					Type 3					Type 4				
			T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1
NCB1,5...M...N0...	90	100	74	89	100	100	100	69	84	100	100	100	51	66	85	85	85	39	54	67	67	67
NCB2-12GK...-N0...	90	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NCB2-12GM...-N0...	90	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NCB4-12GM...-N0...	120	50	74	89	100	100	100	69	84	100	100	100	51	66	74	74	74	39	52	52	52	52
NCN4-12GK...-N0...	95	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NCN4-12GM...-N0...	95	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NCB5-18GK...-N0...	95	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NCB5-18GM...-N0...	95	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NCB8-18GM...-N0...	120	50	74	89	100	100	100	69	84	100	100	100	51	66	74	74	74	39	52	52	52	52
NCN8-18GK...-N0...	95	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NCN8-18GM...-N0...	95	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NCB10-30GK..-N0...	105	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NCB10-30GM..-N0...	105	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NCB15-30GM...-N0...	120	150	74	89	100	100	100	69	84	100	100	100	51	66	74	74	74	39	52	52	52	52
NCN15-30GK...-N0...	110	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NCN15-30GM...-N0...	110	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 0,2-10GM-N...	20	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 0,8-4,5-N...	30	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 0,8-5GM-N...	30	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 1,5-6,5...-N...	30	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 1,5-10GM-N-Y...	20	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 1,5-8GM-N...	30	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 1,5-8-N...	20	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42
NJ 1,5-18GM-N-D...	50	60	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 2-11-N...	45	50	73	88	100	100	100	66	81	100	100	100	45	60	89	89	89	30	45	74	74	74
NJ 2-11-N-G...	30	50	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 2-12GK-N...	45	50	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 2-12GM-N...	30	50	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 2-14GM-N...	30	50	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 2,5-14GM-N...	30	50	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 4-12GK-N...	45	50	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 4-14GK-N...	45	50	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 4-12GM-N...	45	50	73	88	100	100	100	68	83	100	100	100	49	64	67	67	67	36	42	42	42	42

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

Continuation Table 3: Application as EPL-Gb equipment

Type	C_i [nF]	L_i [µH]	Type 1					Type 2					Type 3					Type 4				
			T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1	T6	T5	T4	T3	T2-T1
NJ 4-30GM-N-200... (oscillator unit)	70	100	73	88	123	188	192	66	81	116	181	186	45	60	95	160	164	30	45	80	145	149
NJ 4-30GM-N-200... (amplifier unit)	70	100	73	88	100	100	100	66	81	100	100	100	45	60	89	89	89	30	45	74	74	74
NJ 5-10-11-N...	70	100	73	88	100	100	100	66	81	100	100	100	45	60	78	78	78	30	45	57	57	57
NJ 5-11-N...	45	50	72	87	100	100	100	65	80	100	100	100	42	57	82	82	82	26	41	63	63	63
NJ 5-18GK-N...	70	50	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 5-18GK-N-150...	70	50	73	88	124	150	150	69	84	119	150	150	51	66	101	150	150	39	54	89	136	136
NJ 5-18GM-N...	70	50	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 6-22-N...	130	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 8-18GK-N...	70	50	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 8-18GK-N-150...	70	50	73	88	124	150	150	69	84	119	150	150	51	66	101	150	150	39	54	89	136	136
NJ 8-18GM-N...	70	50	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 10-22-N...	130	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 10-30GK...-N...	140	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 10-30GM-N...	140	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 15-30GK...-N...	140	100	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 15-30GK-N-150...	140	100	73	88	124	150	150	69	84	119	150	150	51	66	101	150	150	39	54	89	136	136
NJ 15-30GM-N...	140	100	76	91	100	100	100	73	88	100	100	100	62	77	81	81	81	54	63	63	63	63
NJ 25-50-N...	150	140	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61
NJ 20-40-N...	140	140	73	88	100	100	100	69	84	100	100	100	51	66	80	80	80	39	54	61	61	61

Table 3

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

For relationship between type of connected circuit, maximum ambient temperature for the application as EPL-Da or Db equipment as well as the effective internal reactances for the individual types of cylindrical inductive sensors, reference is made to the following table 4:

Types	C_i [nF]	L_i [µH]	Type 1	Type 2	Type 3	Type 4
			Maximum permissible ambient temperature in °C			
NCB1,5...M...N0...	90	100	100	100	85	67
NCB2-12GK...-N0...	90	100	100	100	80	61
NCB2-12GM...-N0...	90	100	100	100	81	63
NCB4-12GM...-N0...	120	50	100	100	85	67
NCN4-12GK...-N0...	95	100	100	100	80	61
NCN4-12GM...-N0...	95	100	100	100	81	63
NCB5-18GK...-N0...	95	100	100	100	80	61
NCB5-18GM...-N0...	95	100	100	100	81	63
NCB8-18GM...-N0...	120	50	100	100	85	67
NCN8-18GK...-N0...	95	100	100	100	80	61
NCN8-18GM...-N0...	95	100	100	100	81	63
NCB10-30GK...-N0...	105	100	100	100	80	61
NCB10-30GM...-N0...	105	100	100	100	81	63
NCB15-30GM...-N0...	120	150	100	100	85	67
NCN15-30GK...-N0...	110	100	100	100	80	61
NCN15-30GM...-N0...	110	100	100	100	81	63
NJ 0,2-10GM-N...	20	50	100	100	67	41
NJ 0,8-4,5-N...	30	50	100	100	67	41
NJ 0,8-5GM-N...	30	50	100	100	67	41
NJ 1,5-6,5...-N...	30	50	100	100	67	41
NJ 1,5-10GM-N-Y...	20	50	100	100	67	41
NJ 1,5-8GM-N...	30	50	100	100	67	41
NJ 1,5-8-N...	20	50	100	100	67	41
NJ 1,5-18GM-N-D...	50	60	100	100	81	63
NJ 2-11-N...	45	50	100	100	89	74
NJ 2-11-N-G...	30	50	100	100	81	63
NJ 2-12GK-N...	45	50	100	100	80	61
NJ 2-12GM-N...	30	50	100	100	81	63
NJ 2-14GM-N...	30	50	100	100	81	63
NJ 2,5-14GM-N...	30	50	100	100	81	63
NJ 4-12GK-N...	45	50	100	100	80	61
NJ 4-14GK-N...	45	50	100	100	80	61
NJ 4-12GM-N...	45	50	100	100	67	41
NJ 4-30GM-N-200... (oscillator unit)	70	100	100	100	95	80
NJ 4-30GM-N-200... (amplifier unit)	70	100	100	100	89	74
NJ 5-10-11-N...	70	100	100	100	78	57
NJ 5-11-N...	45	50	100	100	82	63
NJ 5-18GK-N...	70	50	100	100	80	61
NJ 5-18GK-N-150...	70	50	100	100	100	89
NJ 5-18GM-N...	70	50	100	100	81	63
NJ 6-22-N...	130	100	100	100	80	61
NJ 8-18GK-N...	70	50	100	100	80	61
NJ 8-18GK-N-150...	70	50	100	100	100	89
NJ 8-18GM-N...	70	50	100	100	81	63
NJ 10-22-N...	130	100	100	100	80	61

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

NJ 10-30GK...-N...	140	100	100	100	80	61
NJ 10-30GM-N...	140	100	100	100	81	63
NJ 15-30GK...-N...	140	100	100	100	80	61
NJ 15-30GK-N-150...	140	100	100	100	100	89
NJ 15-30GM-N...	140	100	100	100	81	63
NJ 25-50-N...	150	140	100	100	80	61
NJ 20-40-N...	140	140	100	100	80	61

Table 4

Special conditions for safe use

1. For the application within a temperature range of -60 °C to -20 °C the cylindrical inductive sensors of types NC... and NJ...shall be protected against damage due to impact by mounting into an additional housing.
2. The connection facilities of the cylindrical inductive sensors of types NC... and NJ...shall be installed as such that a minimum degree of protection of IP20 in accordance with EN 60529 is met.
3. For relationship between type of the connected circuit, maximum permissible ambient temperature and temperature class as well as the effective internal reactances for the individual types of cylindrical inductive sensors, reference is made to tables 2 and 3 given in this 6. supplement to EC-type-examination certifcate PTB 00 ATEX 2048 X.
4. Inadmissible electrostatic charge of parts of the metal housing has to be avoided for the following types of cylindrical inductive sensors. Dangerous electrostatic charge of parts of the metal housing can be avoided by grounding these parts whereas very small parts of the metal housing (e.g. screws) do not need to be grounded:

NCB1,5...M...N0...
NCB2-12GM...-N0...
NCB4-12GM...-N0...
NCB5-18GM...-N0...
NCB8-18GM...-N0...
NCB10-30GM..-N0...
NCB15-30GM...-N0...
NCN4-12GM...-N0...
NCN8-18GM...-N0...
NCN15-30GM...-N0...
NJ 0,2-10GM-N...
NJ 0,8-4,5-N...
NJ 0,8-5GM-N...
NJ 1,5-6,5...-N...
NJ 1,5-10GM-N-Y...
NJ 1,5-8GM-N...
NJ 1,5-8-N...
NJ 1,5-18GM-N-D...
NJ 2-11-N-G...
NJ 2-12GM-N...
NJ 2-14GM-N...
NJ 2,5-14GM-N...
NJ 4-12GM-N...
NJ 4-30GM-N-200...
NJ 5-11-N-545...
NJ 5-11-N-G...
NJ 5-18GM-N...
NJ 6-22-N-G...
NJ 8-18GM-N...
NJ 10-22-N-G...
NJ 10-30GM-N...
NJ 15-30GM-N...

5. Inadmissible electrostatic charge of the plastic enclosures shall be avoided for the application of the following cylindrical inductive sensors according to the explosion groups and equipment categories specified in the following Table 5. When the respective types of cylindrical inductive sensors are applied in potentially explosive gas atmospheres a corresponding warning note shall be affixed on the sensors or near the sensors respectively. When the sensors are applied in potentially explosive dust atmospheres the corresponding notes given in the operating instructions manual shall be considered.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
Nationales Metrologieinstitut

6. SUPPLEMENT TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

Type	Group II (1 G)	Group II (2 G)	Group III (1D or 2D)
NCB10-30GM..-N0...	IIC	-	III
NCN15-30GM...-N0...	IIC	-	III
NJ 10-30GM-N...	IIC	-	III
NJ 15-30GM-N...	IIC	-	III
NJ 4-30GM-N-200...	IIC	-	-
NJ 5-18GK-N...	IIC	-	III
NJ 8-18GK-N...	IIC	-	-
NJ 15-30GK-N...	IIC	-	III
NJ 5-18GK-N-150...	IIC	-	-
NJ 8-18GK-N-150...	IIC	-	-
NJ 15-30GK-N-150...	IIC	-	III
NCB15-30GM...-N0...	IIC	-	III
NJ 20-40-N...	not permitted	IIC	III
NJ 25-50-N...	not permitted	IIC	III
NCB5-18GK...-N0...	not permitted	-	III
NCB10-30GK...-N0...	not permitted	-	III
NCN8-18GK...-N0...	not permitted	-	III
NCN15-30GK...-N0...	not permitted	-	III
NJ 10-22-N...	not permitted	-	III
NJ 10-30GK...-N...	not permitted	-	III
NJ 15-30GK...-N...	not permitted	-	III

Applied standards

EN 60079-0: 2012 + A11:2013, EN 60079-11: 2012

Test report: PTB Ex 15-25162

Konformitätsbewertungsstelle, Sektor Explosionsschutz
On behalf of PTB:

Braunschweig, January 15, 2016

Dr.-Ing. U. Johannsmeyer
Direktor und Professor

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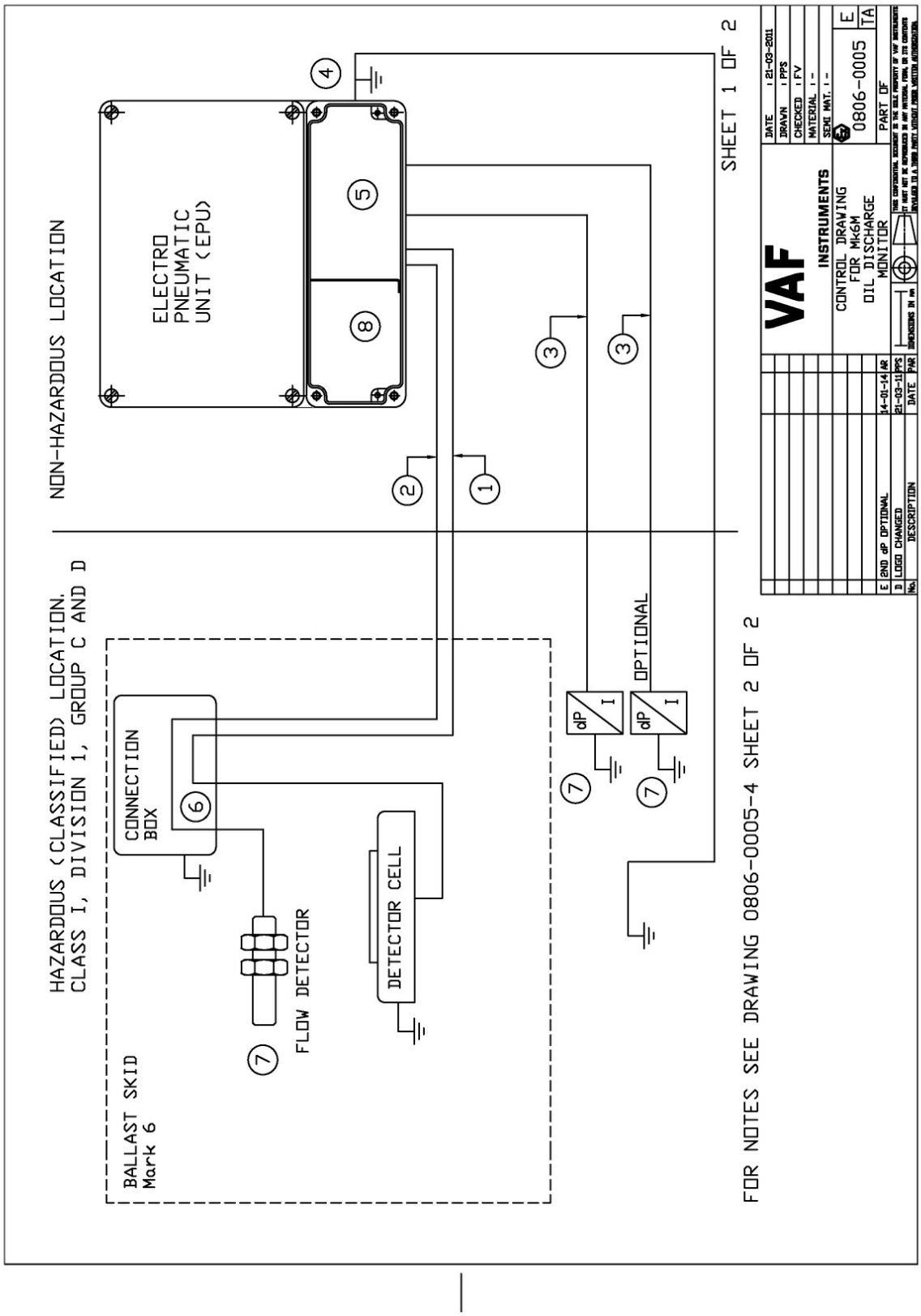
16.2 CERTIFICATES OF TYPE APPROVAL

Certificate	Type	For
DNV-GL *Det Norske Veritas – Germanischer Lloyd*	EC type examination certificate	Oilcon® Oil Discharge Monitoring and Control System Oilcon Mark 6M
ABS *American Bureau of Shipping*	Confirmation of Product Type Approval	Oilcon® Oil Discharge Monitoring and Control System Oilcon Mark 6M
CCS *China Classification Society*	Certificate of Type Approval	Oilcon® Oil Discharge Monitoring and Control System Oilcon Mark 6M
NKK *Nippon Kaiji Kyokai*	Certificate of Type Approval	Oilcon® Oil Discharge Monitoring and Control System Oilcon Mark 6M
RMRS *Russian Maritime Register of Shipping*	Certificate of Type Approval	Oilcon® Oil Discharge Monitoring and Control System Oilcon Mark 6M
USCG *United States Coast Guard*	Certificate of Approval	Oilcon® Oil Discharge Monitoring and Control System Oilcon Mark 6M

NOTE:
MOST RECENT COPIES OF ABOVE MENTIONED CERTIFICATES OF TYPE APPROVAL ARE AVAILABLE ON OUR WEB-SITE WWW.VAF.NL

17 DRAWINGS

	Description:	Drawing number:
1/2	Control drawing for Mark 6M Oil Discharge Monitor	0806-0005
3	Dimensional drawing ball valve flowmeter kit Ballast Monitor	0806-1041
4	Dimensional drawing motor starter box Ballast Monitor Mark 6	0806-1075
5	Dimensional drawing sample pump/motor Ballast Monitor Mark 6	0806-1076
6	Dimensional drawing sample valve Mark 6	0806-1077
7/8	Assembly drawing sample pump Ballast Monitor Mark 6	0806-1260
9	Part list sampling probe pipe connection Ø15 mm Ballast Monitor Mark 6M	0806-1265
10	Part list motor starter box Ballast Monitor Mark 6	0806-1267
11	Part list isolating valve Ø15 Ballast Monitor Mark 6	0806-1268
12	Part list detector cell Mark 6	0806-1279
13	Dimensional drawing MCU Mark 6M	0806-1285
14	Basic spare parts kit Ballast Monitor Mark 6M	0806-1286
15	Dimensional drawing and parts list EPU 1-2 sample valves Mark 6M	0806-1287
16	Dimensional drawing and parts list ballast skid Mark 6M	0806-1288
17	Grab cock and injection point Ballast Monitor Mark 6	0806-1621
18	Light scatter cell Ballast Monitor Mark 6	0806-1622
19	Connection diagram motor starter box Mark 6	0806-2032
20	Electrical connection diagram Ballast Monitor Mark 6M MEPC 108(49)	0806-2048
21	Connection diagram Oilcon Mark 6 Cable spec. MEPC 108(49)	0806-2050
22	Schematic diagram overboard valve control Ballast Monitor Mark 5/6	0806-5019
23	Schematic diagram Oilcon Ballast Monitor Mark 6M	0806-5026
24	Installation flowmeter Ballast Monitor Mark 5/6	0806-8016
25	Installation requirements fresh water supply line Ballast Monitor Mark 5/6	0806-8023
26	Schematic installation diagram Oilcon Monitor System with 1x dP/I transmitter Mark 6	0806-8035
27/28/29/30	Bulkhead penetration and piping diagram Mark 6M	0806-8038
31	Schematic pipe arrangement skid Mark 6	0806-8039
32	Cable termination instruction Ballast Monitor Mark 6	0806-8040
33	Multi cable transit Ballast Monitor Mark 6	0806-8070
34	Connection diagram dP/I transmitter type Fuji / ABB	0810-2010
35	Parts list window wash pump	0871-1213
36	Dimensional drawing dP/I transmitter FUJI flowmeter kit Ballast Monitor Mark 5/6	0899-1092
37	Dimensional drawing dP/I transmitter ABB flowmeter kit Ballast Monitor Mark 5/6	0899-1163
38	Parts list FUJI dP/I transmitter flowmeter kit Mark 5/6	0899-1249
39	Parts list FUJI pressure reducing valve fresh water connection ½" BSPT Ballast Monitor Mark 6	0899-1256
40	Parts list air supply units Ballast Monitor Mark 6	0899-1258
41	Parts list ABB dP/I transmitter flowmeter kit Mark 5/6	0899-1259



Drawing 1 – 0806-0005 – Sheet 1/2

Notes:

1. Total maximum cable parameters in the circuit to sensor belonging to the Electro Pneumatic Unit:
   Lo/Ro=46 µH/Ohm

2. Maximum entity parameters to intrinsically safe flow detector:
   Voc = 14 V
   Isc = 20 mA
   Po = 69 mW
   Ca = 4.6 µF
   La = 350 mH

3. Maximum entity parameters to intrinsically safe differential pressure sensor:
   Voc = 21 V
   Isc = 82 mA
   Po = 0.43 W
   Ca = 1.23 µF
   La = 20 mH

4. Connect P.E. connection of barrier circuit to the P.E. system within the potentially explosive atmosphere per National Electrical Code NFPA 70, Article 504.

5. Connect the circuits to the terminations as shown in the instruction manual.

6. Terminate the two circuits in the junction box with an increased protection suitable is its environment, but at leased IP54 / NEMA 4.
   Keep the terminals of the sensor circuits and the flow detector circuit at least 6 mm (0.25 inch) apart from each other.

7. Connect only approved intrinsically safe apparatus which complies with the following:
   The entity concept allows interconnection of intrinsically safe apparatus with the Electro Pneumatic Unit when approved values of Voc, Isc and Pmax of the Electro Pneumatic Unit are less than or equal to Vmax, Imax and Pi of the approved intrinsically safe apparatus and the approved values of Ca and La of the Electro Pneumatic Unit are greater the Ci and Li of the approved intrinsically safe apparatus, including the capacitance and inductance of the interconnecting cable.

8. Connect only non-intrisically safe circuits with Um = 250 Vrms maximum.

9. The installation shall be in accordance with the National Electrical Code NFPA 70, Article 504 and ANSI/ISA-RP-12.6.

10. Ambient temperature range -40°C ... +60°C (-40°F ... +140°F).

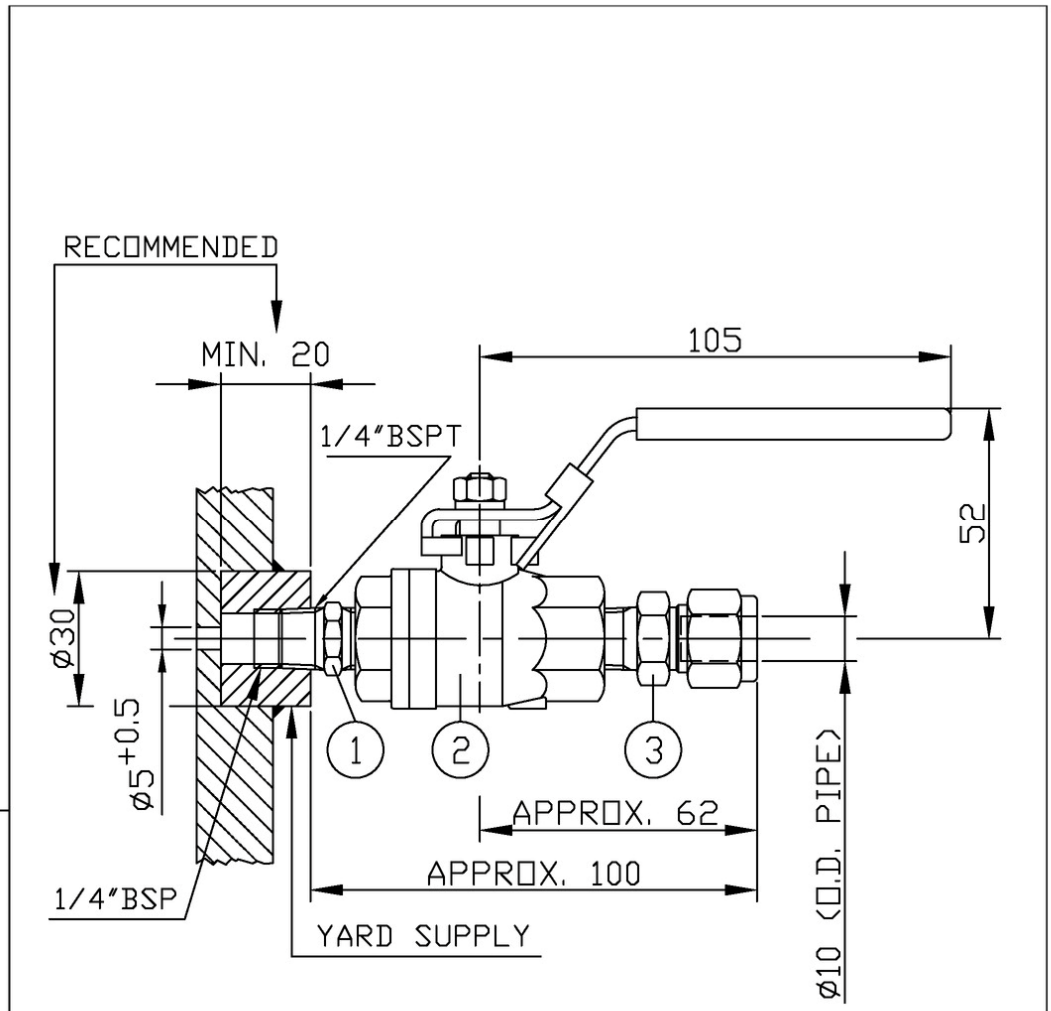
11. WARNING:
SUBSTITUTION OF COMPONENTS MAY IMPAIR THE INTRINSIC SAFETY.

FOR LOCATION SEE DRAWING 0806-0005 SHEET 1 OF 2

SHEET 2 OF 2

				VAF INSTRUMENTS	DATE : 21-03-2011
					DRAWN : PPS
					CHECKED : BV
					MATERIAL : -
					SEMI MAT. : -
				NOTES CONTROL DRW. FOR MK6 OIL DISCHARGE MONITOR	Ex 0806-0005 D TA
					PART OF
D	LOGO CHANGED	21-03-11	PPS	DIMENSIONS IN mm	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.
No.	DESCRIPTION	DATE	PAR		

Drawing 2 – 0806-0005 – Sheet 2/2



ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0621-0243	1	NIPPLE, 2 x 1/4" BSPT MALE	AISI 316
2	0622-0029	1	BALL VALVE, 2 x 1/4" BSP FEMALE	AISI 316
3	0621-0244	1	MALE CONNECTOR, 1/4" BSPT x 10mm	AISI 316

WEIGHT: 0,5 KG

No.	DESCRIPTION	DATE	PAR
-	-	-	-
I	WEIGHT	19-02-14	AR
H	LOGO CHANGED	07-06-11	FV

VAF INSTRUMENTS

DIMENSIONAL DRAWING
BALL VALVE
FLOWMETER KIT
BALLAST MONITOR

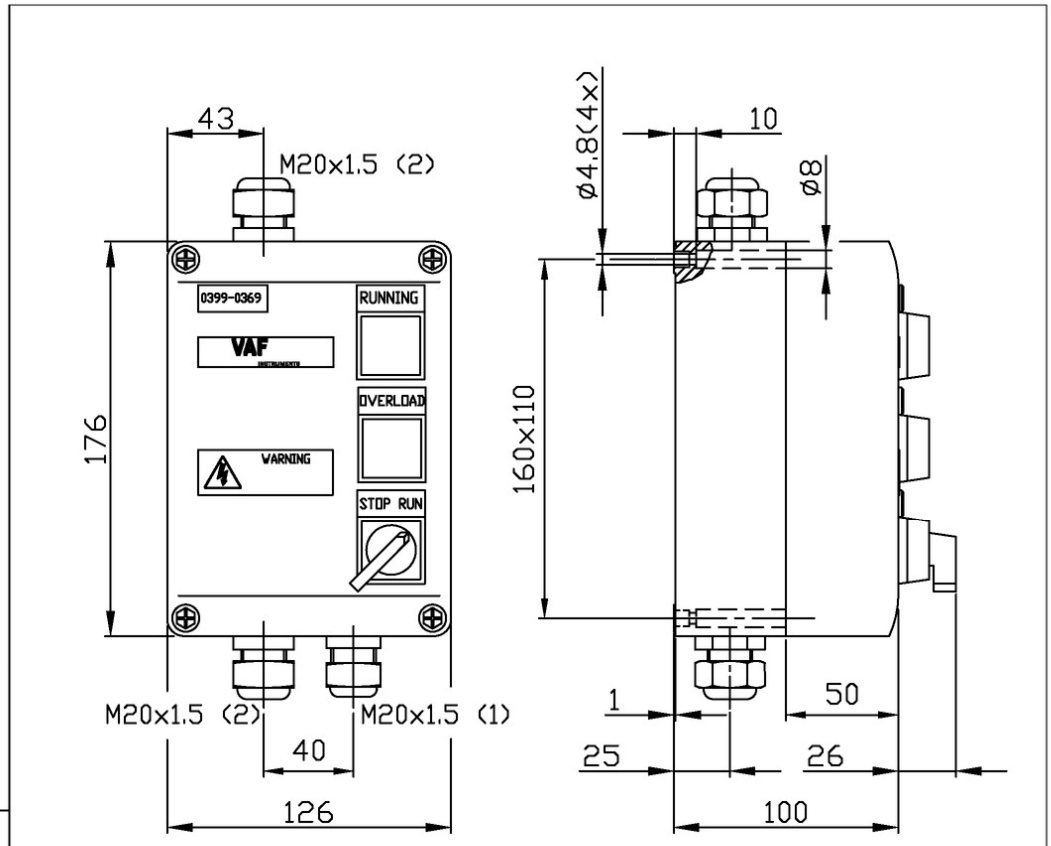
DATE : 31-03-94
DRAWN : A.v.Nies
CHECKED : BV
MATERIAL :
SEMI MAT. : -

0806-1041 I
TA

PART OF 0399-0282

DIMENSIONS IN mm

Drawing 3 – 0806-1041



MAGNET RELAY : 24VDC
THERMAL RELAY FOR
380-420VAC ⅄ 50Hz : 1.8 - 2.6 A
440-480VAC ⅄ 60Hz : 1.8 - 2.6 A
PROTECTION CLASS : IP68 (5 bar)
CABLE GLAND M20x1.5 (1) : CABLE DIA ø 6-12
CABLE GLAND M20x1.5 (2) : CABLE DIA ø10-14

CONNECTION DIAGRAM 0806-2032-4
PARTS LIST 0806-1267-4

WEIGHT: 1 KG

No.	DESCRIPTION	DATE	PAR
-	-	-	-
D	WEIGHT	19-02-15	AR
C	LOGO CHANGED	21-03-11	PPS

VAF INSTRUMENTS

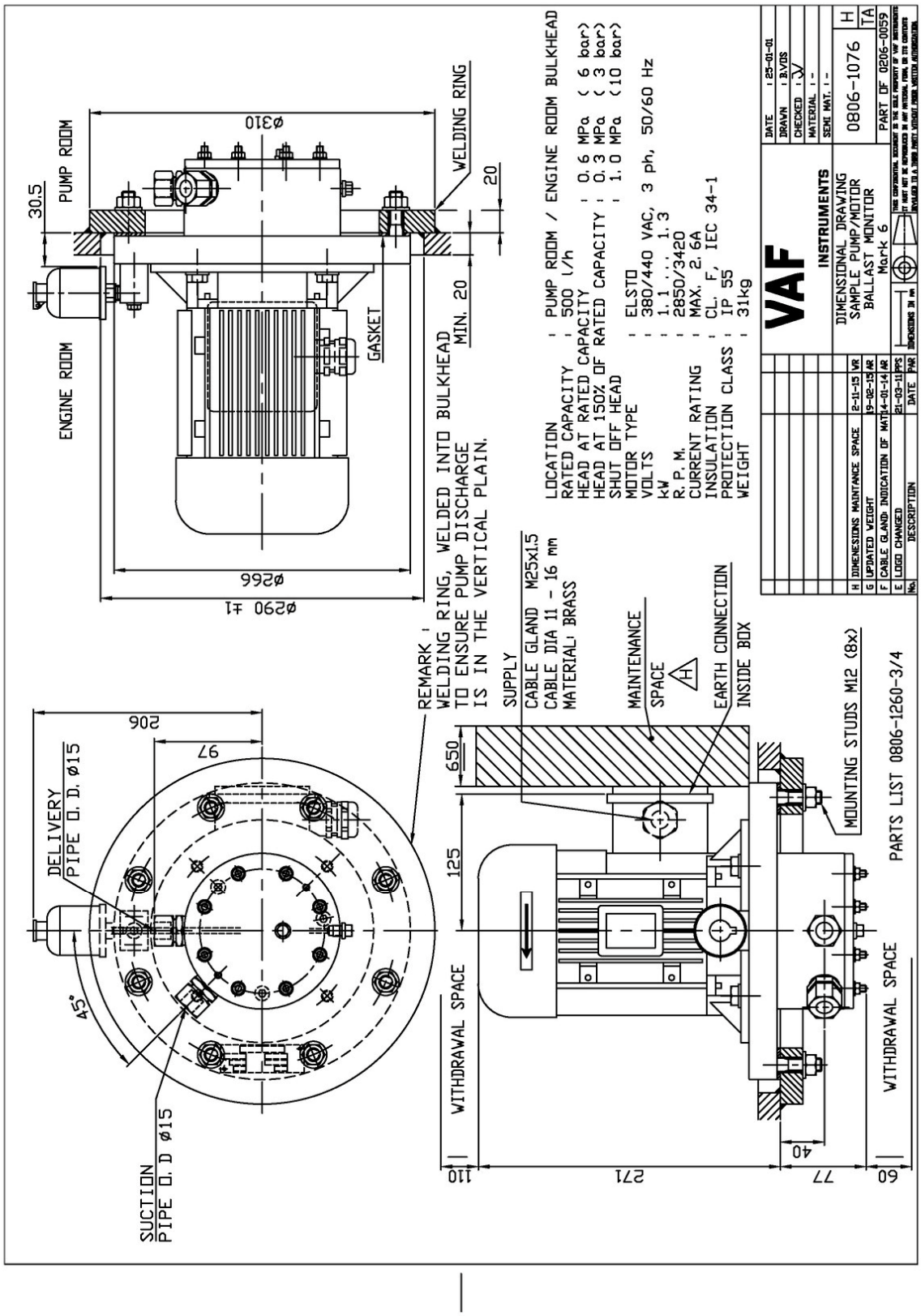
DIMENSIONAL DRAWING
MOTOR STARTER BOX
BALLAST MONITOR
Mark 6

DIMENSIONS IN mm

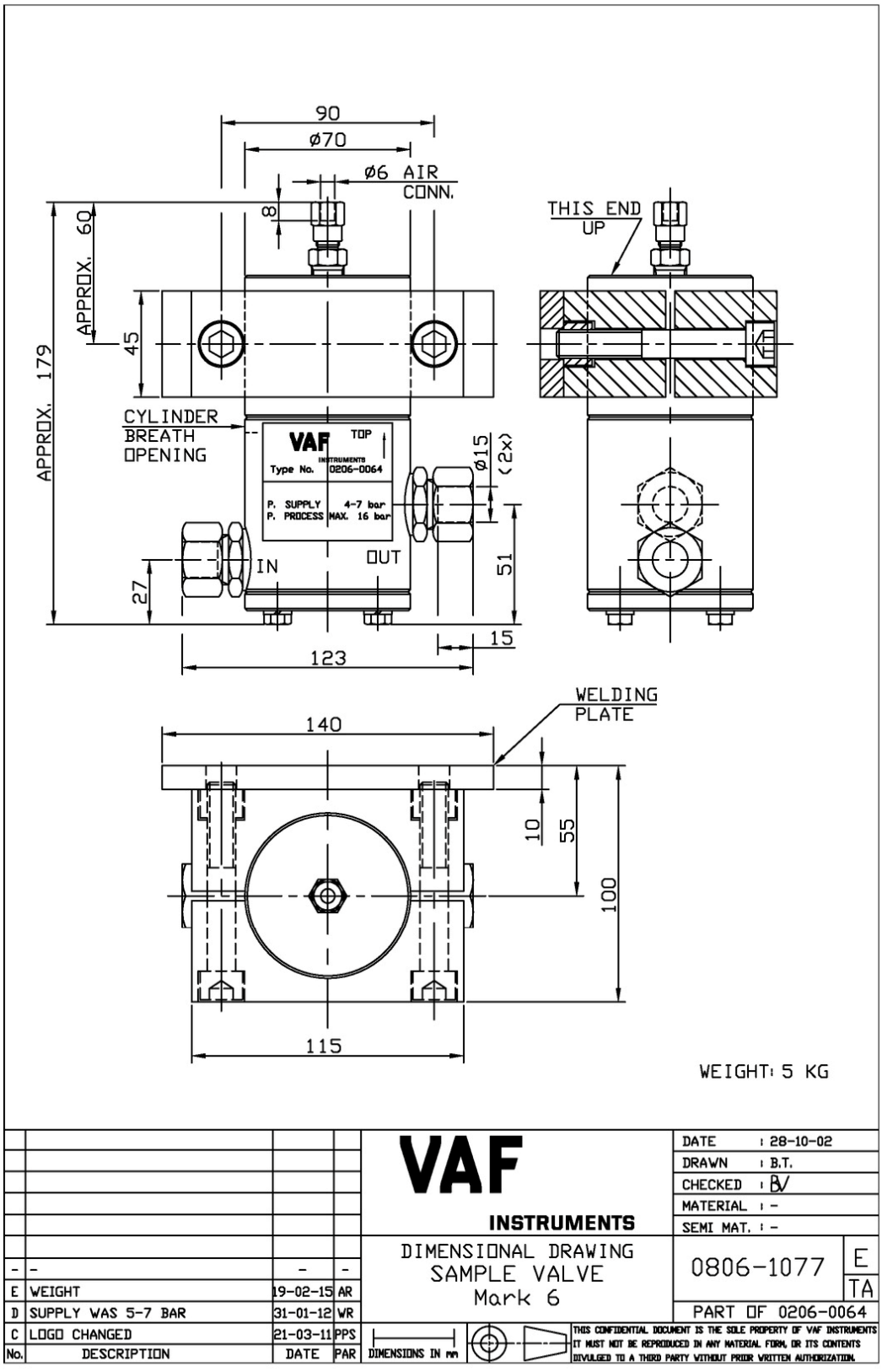
DATE : 18-01-02
DRAWN : B.VOS
CHECKED : JV
MATERIAL : -
SEMI MAT. : -

0806-1075 D
TA
PART OF 0399-0369

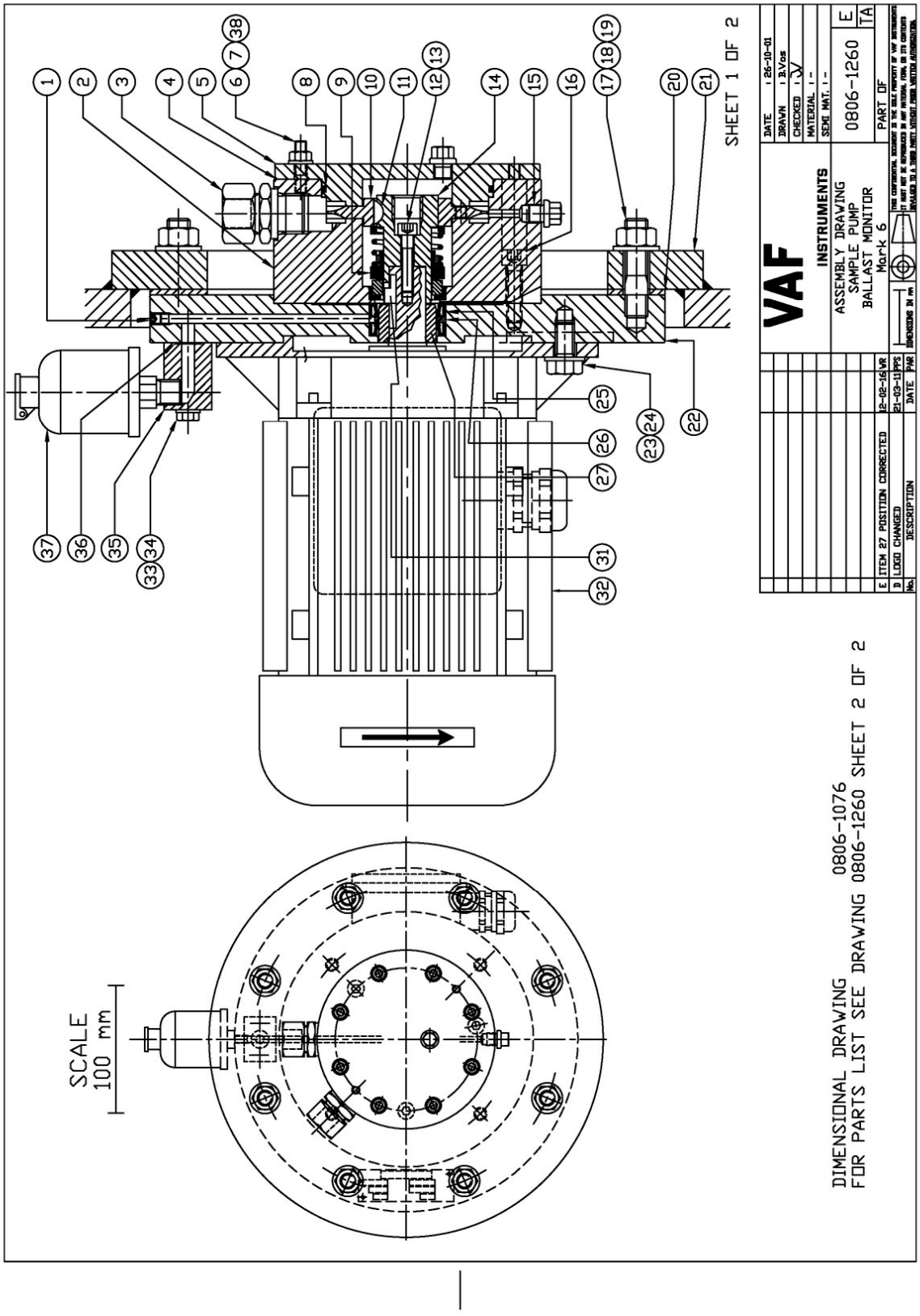
Drawing 4 – 0806-1075



Drawing 5 – 0806-1076



Drawing 6 – 0806-1077



Drawing 7 – 0806-1260 – Sheet 1/2

ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0731-0606	1	SCREW, M6 x 6 mm	STEEL 45H
2	0401-0780	1	HOUSING, ø140 x 65 mm	BRONZE
3	0621-0141	2	MALE CONNECTOR 1/2" BSP ø15 mm	SoMs59/AISI 316
4	0431-0053	1	SET PACKING RINGS ø140 x ø90 mm THICKNESS 2x 50, 2x 100 AND 1x 190 micrometer	MELINEX
5	0402-0611	1	COVER, ø139 x 22 mm	BRONZE
6	1735-0620	8	STUD, M6 x 20 mm, DIN 939	AISI 316
7	1734-0600	8	HEXAGON NUT, M6, (L TOTAL 27.5 mm) DIN 934	AISI 316
8	0630-3152	1	O-RING, ID 82.22 x ø2.62 mm	VITON
9	0634-0017	1	MECHANICAL SEAL, ø40 x ø25 x Lo 70 mm	CARBON/CERAMIC
10	0479-0008	1	IMPELLER, ø85 x 15 mm	MONEL
11	1744-0005	1	WOODRUFF KEY, 4 x 5 mm, DIN 6888	AISI 316
12	1728-0630	1	HEX. SOCKET HEAD CAP SCREW, M6x30 mm, DIN 912	AISI 316
13	0630-6020	1	O-RING, ID 6 x ø1 mm	VITON
14	0415-0102	1	COUPLING, ø32 x 56.5 mm	BRONZE
15	1726-1013	2	PLUG 1/8" BSP, DIN 910	AISI 316
16	1728-0830	3	HEX. SOCKET HEAD CAP SCREW, M8x30 mm, DIN 912	AISI 316
17	0799-0070	8	STUD, M12 x 40 mm, (L TOTAL 55mm) DIN 939	STEEL 8.8
18	0716-1200	8	WASHER, ø24 x ø13 x 2.5 mm, DIN 125	STEEL
19	0734-1200	8	HEXAGON NUT, M12, DIN 934	STEEL 8
20	0431-0052	1	PACKING, ø266 x ø210 x 3 mm	NON ASBESTOS
21	0411-0272	1	WELDING RING, ø310 x ø210 x 20 mm	STEEL
22	0414-0138	1	FLANGE, ø266 x 25 mm	STEEL
23	0733-1020	4	HEXAGON SCREW, M10 x 20 mm, DIN 933	STEEL 8.8
24	0716-1000	4	WASHER, ø20 x ø10.5 x 2 mm, DIN 125	STEEL
25	0634-0016	2	OIL SEALING, ø40 x ø30 x 7 mm	NITRILE
26	0411-0273	1	LANTERN RING, ø40 x ø31 x 3 mm	STEEL
27	0499-0718	1	BUSHING, ø30 x ø19 x 20 mm	STEEL, HRD
31	0479-0007	1	KEY, 6 x 6 x 15 mm	STEEL, HRD
32	0672-0044	1	ELECTROMOTOR 380/440VAC, 3ph, 50/60Hz	
33	0732-0645	2	HEXAGON BOLT, M6 x 45 mm, DIN 931	STEEL 8.8
34	0716-0600	2	WASHER, ø12 x ø6.4 x 1.6 mm, DIN 125	STEEL
35	0440-0005	1	BLOCK, 35 x 35 x 25 mm	STEEL
36	0630-6013	1	O-RING, ID 12 x ø1 mm	VITON
37	0609-0257	1	OIL RESERVOIR	POLYCARBONAAT
38	1716-0600	8	WASHER, ø12.5 x ø6.4 x 1.6 mm, DIN 125	AISI 316

ITEMS 4, 8, 9, 11, 12, 13, 14, 25 (2x) AND 26 ARE INCLUDED IN SAMPLE PUMP SPARE PARTS KIT 0390-1182

ITEMS 4, 8, 9, 10, 11, 12, 13, 14, 25 (2x) AND 26 ARE INCLUDED IN SAMPLE PUMP AND IMPELLER SPARE PARTS KIT 0390-1210

ITEMS 27, 31 AND 32 ARE INCLUDED IN SAMPLE PUMP ELECTRIC MOTOR SPARE PARTS KIT 0390-1209

FOR ASSEMBLY DRAWING SEE DRAWING 0806-1260 SHEET 1 of 2

SHEET 2 OF 2

VAF INSTRUMENTS

DATE : 26-10-01
DRAWN : B.T.
CHECKED : JV
MATERIAL : -
SEMI MAT. : -

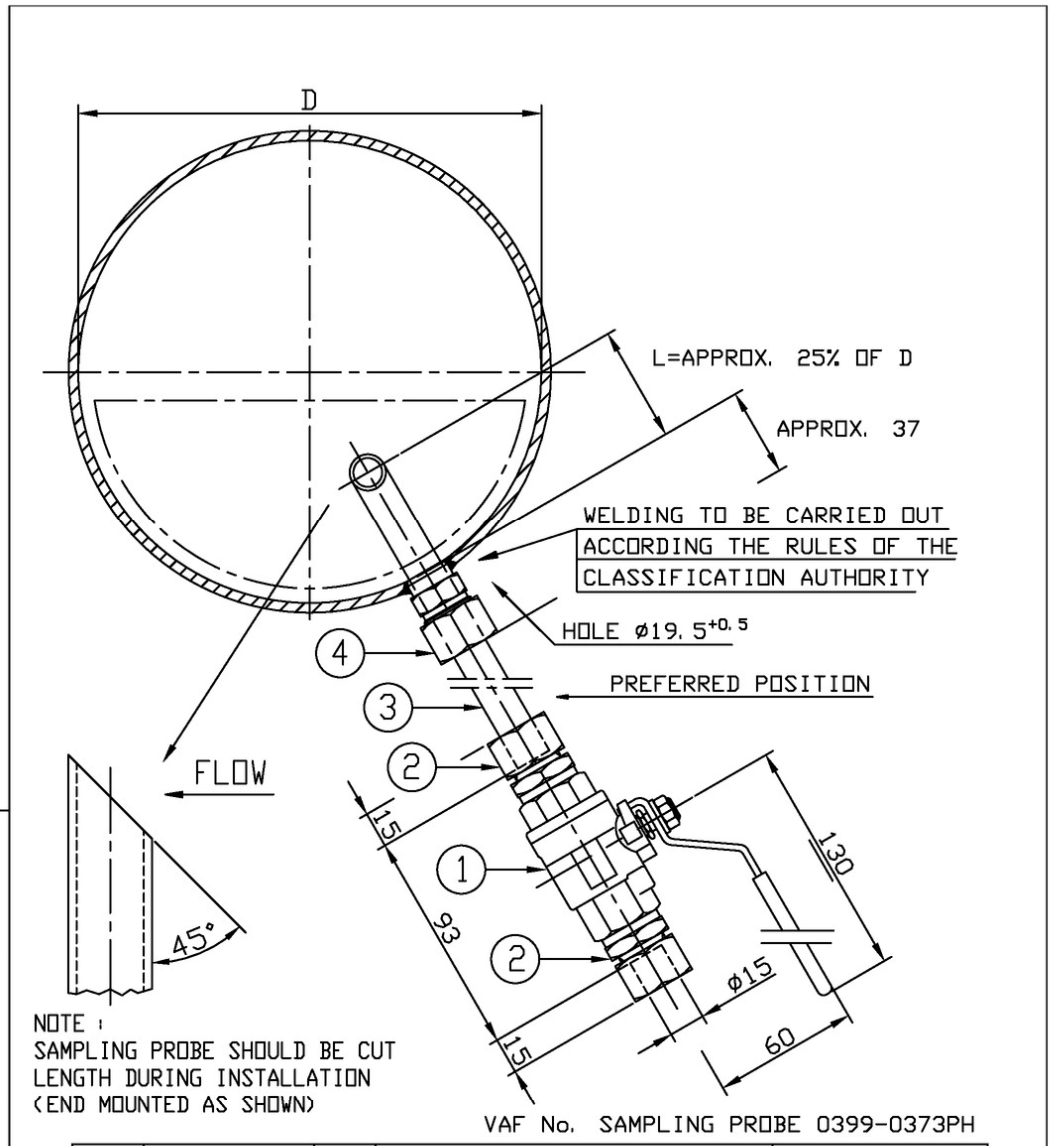
PARTS LIST
SAMPLE PUMP
BALLAST MONITOR
Mark 6

0806-1260 I
PART OF TA

No.	DESCRIPTION	DATE	PAR
I	LOGO CHANGED	21-03-11	PPS

DIMENSIONS IN mm

Drawing 8 – 0806-1260 – Sheet 2/2



VAF No. SAMPLING PROBE 0399-0373PH

ITEM NR.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0622-0032	1	GATE VALVE 2x 1/2" BSP FEMALE	AISI 316
2	0621-0141	2	MALE CONNECTOR 1/2" BSPxø15mm	AISI 316
3	0442-0149	1	TUBE ø15x1.5 L=500mm	AISI 316
4	0499-0683	1	WELDING CONNECTOR PIPE ø15mm	AISI 316

No.	DESCRIPTION	DATE	PAR
F	SIGN.044 ITEM 2 WAS 0621-0297	11-2-16	WR
E	1X ITEM 0621-0297 WAS 0621-0141	21-10-14	AR
D	LOGO CHANGED	21-03-11	PPS

VAF INSTRUMENTS

DATE : 11-01-02
DRAWN : B.Vos
CHECKED : JV
MATERIAL : -
SEMI MAT. : -

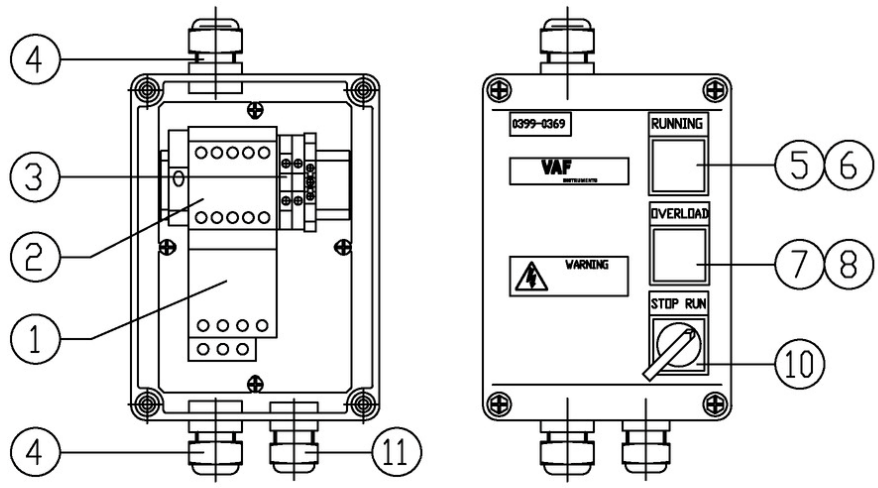
PARTS LIST
SAMPLING PROBE
PIPE CONN. ø15mm
BALLAST MONITOR Mk6

0806-1265 F TA

PART OF 0399-0373PH

DIMENSIONS IN mm

Drawing 9 – 0806-1265



ITEM NR.	PART NUMBER	QTY	PART NAME
1	0652-1045	1	THERMAL RELAY 1.8 - 2.6 A
2	0652-1044	1	MAGNET RELAY 24VDC
3	0646-3039	2	TERMINAL
	0646-3033	1	ENDSTOP
	0646-3040	1	ENDPLATE
4	0646-1296	2	CABLE GLAND M20x1.5 FOR CABLE ø10-14
	0646-1328	2	NUT CABLE GLAND M20x1.5
	0630-6019	2	O-RING ID 17 x ø2, VITON
5	0644-2051	1	LED, GREEN, 24V
6	0647-0047	1	BULBHOLDER GREEN
7	0644-2050	1	LED, RED, 24V
8	0647-0044	1	BULBHOLDER RED
10	0645-0532	1	SWITCH INCLUDING CONTACT BLOCK
11	0646-1295	1	CABLE GLAND M20x1.5 FOR CABLE ø 6-12
	0646-1328	1	NUT CABLE GLAND M20x1.5
	0630-6019	1	O-RING ID 17 x ø2, VITON

ITEMS 5 AND 7 ARE INCLUDED IN
ELECTRIC SPARE PARTS KIT FOR Mk6 0390-1211

DIMENSIONAL DRAWING 0806-1075
CONNECTION DIAGRAM 0806-2032

VAF INSTRUMENTS

DATE : 18-01-02
DRAWN : M vd Sluijs
CHECKED : BV
MATERIAL : -
SEMI MAT. : -

PARTS LIST
MOTOR STARTER BOX
BALLAST MONITOR
Mark 6

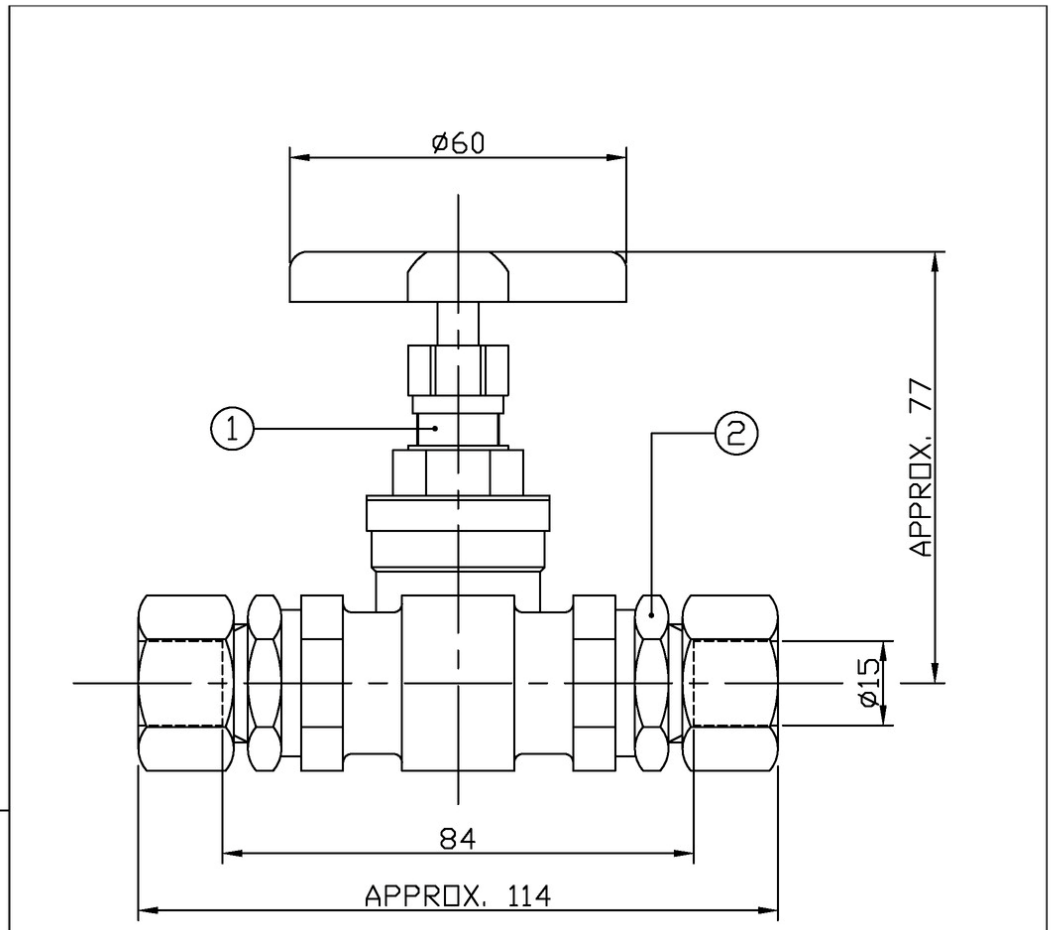
0806-1267 F
TA

PART OF 0399-0369

No.	DESCRIPTION	DATE	PAR
F	LOGO CHANGED	21-03-11	PPS

DIMENSIONS IN mm

Drawing 10 – 0806-1267



ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0622-0035	1	SLIDING VALVE, 2x 1/2" BSP FEMALE	BRASS
2	0621-0297	2	MALE CONNECTOR 1/2" BSP x ø15 mm	AISI316

WEIGHT: 0,5 KG.

No.	DESCRIPTION	DATE	PAR
D	WEIGHT	19-02-15	AR
D	ITEM 2:0622-0297 WAS 0621-0141		
C	LOGO CHANGED	21-03-11	PPS

VAF INSTRUMENTS

PARTS LIST
ISOLATING VALVE ø15
BALLAST MONITOR
Mark 6

DATE : 08-01-02
DRAWN : J.Smaal
CHECKED : BV
MATERIAL : -
SEMI MAT. : -

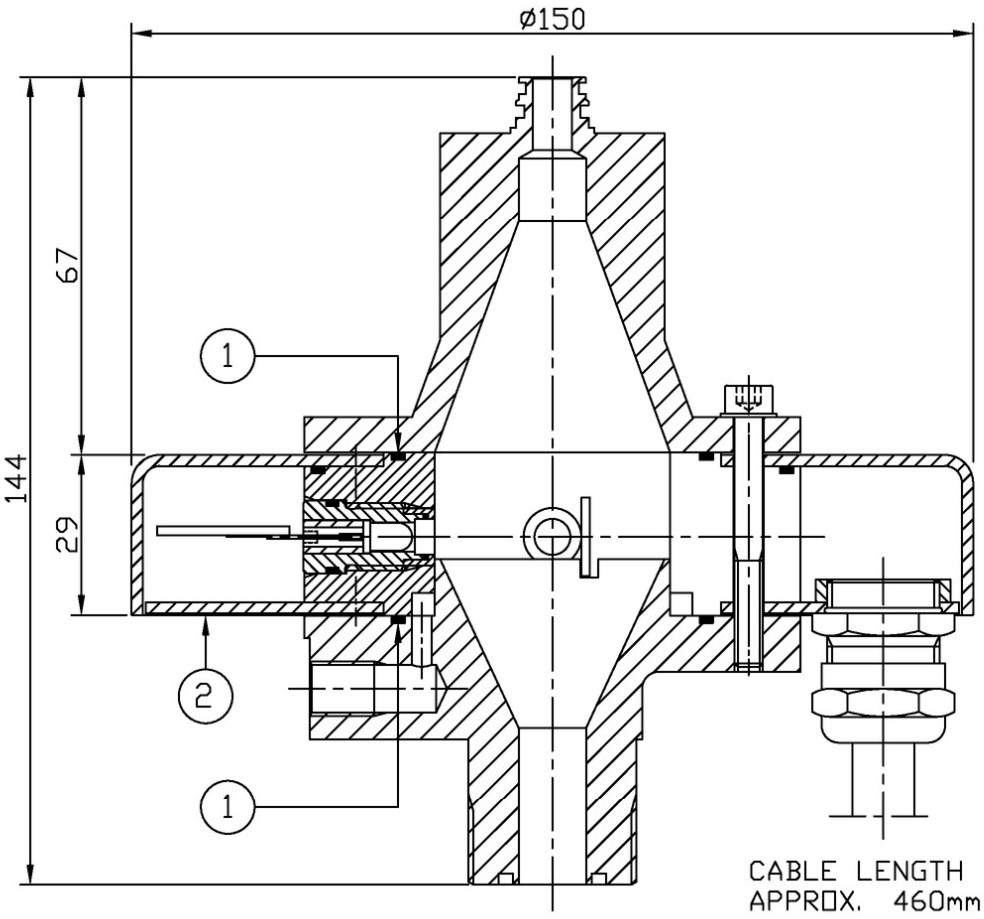
0806-1268 D
TA
PART OF 0399-0371

DIMENSIONS IN mm

Drawing 11 – 0806-1268

ITEM NR.	PART NUMBER	QTY	PART NAME	MATERIAL
1	0630-3034	2	O-RING ID 53.70xø1.78mm	VITON
2	0301-0589	1	DETECTOR CELL INCLUDING CABLE	

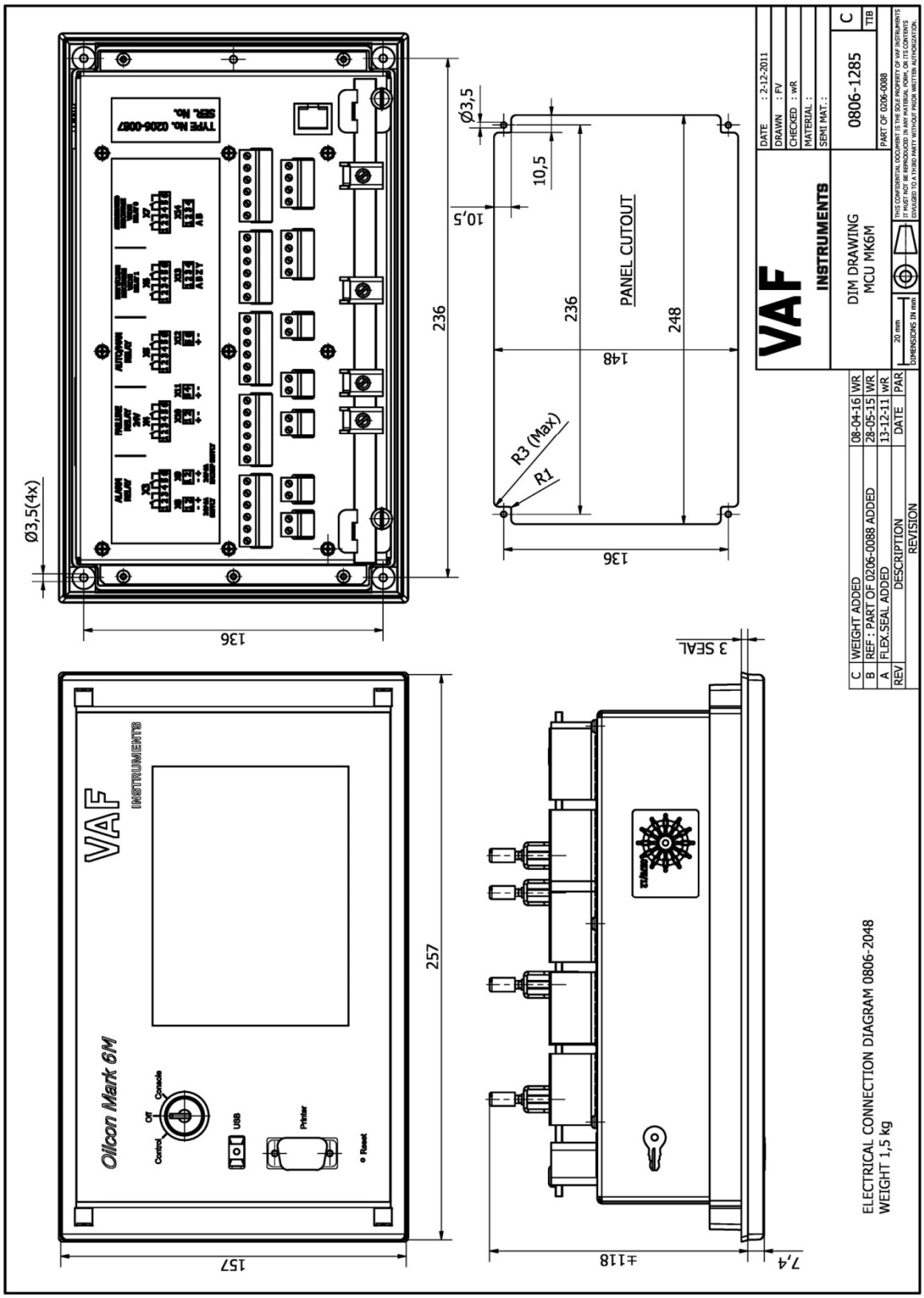
ITEM 1 (2x) AND ITEM 2 (1x) ARE INCLUDED IN SPARE PARTS KIT : DETECTOR CELL ATEX/UL 0390-1233



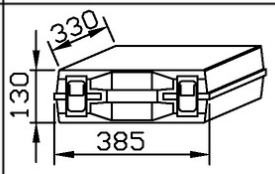
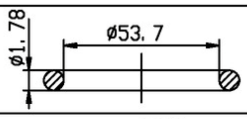
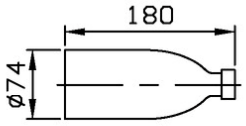
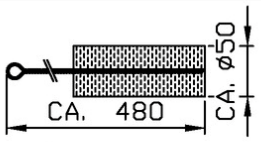
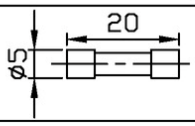
ELECTRIC CONNECTION DIAGRAM 0806-2048

				VAF INSTRUMENTS	DATE : 17-09-04
					DRAWN : M.MOM
					CHECKED : WR
					MATERIAL : -
					SEMI MAT. : -
				PARTS LIST DETECTOR CELL Mark 6M	Ex 0806-1279 E REV
					PART OF 0390-1233
E	LOGO CHANGED	21-03-11	PPS	DIMENSIONS IN mm	THIS CONFIDENTIAL DOCUMENT IS THE SOLE PROPERTY OF VAF INSTRUMENTS IT MUST NOT BE REPRODUCED IN ANY MATERIAL FORM, OR ITS CONTENTS DIVULGED TO A THIRD PARTY WITHOUT PRIOR WRITTEN AUTHORIZATION.
No.	DESCRIPTION	DATE	PAR		

Drawing 12 – 0806-1279

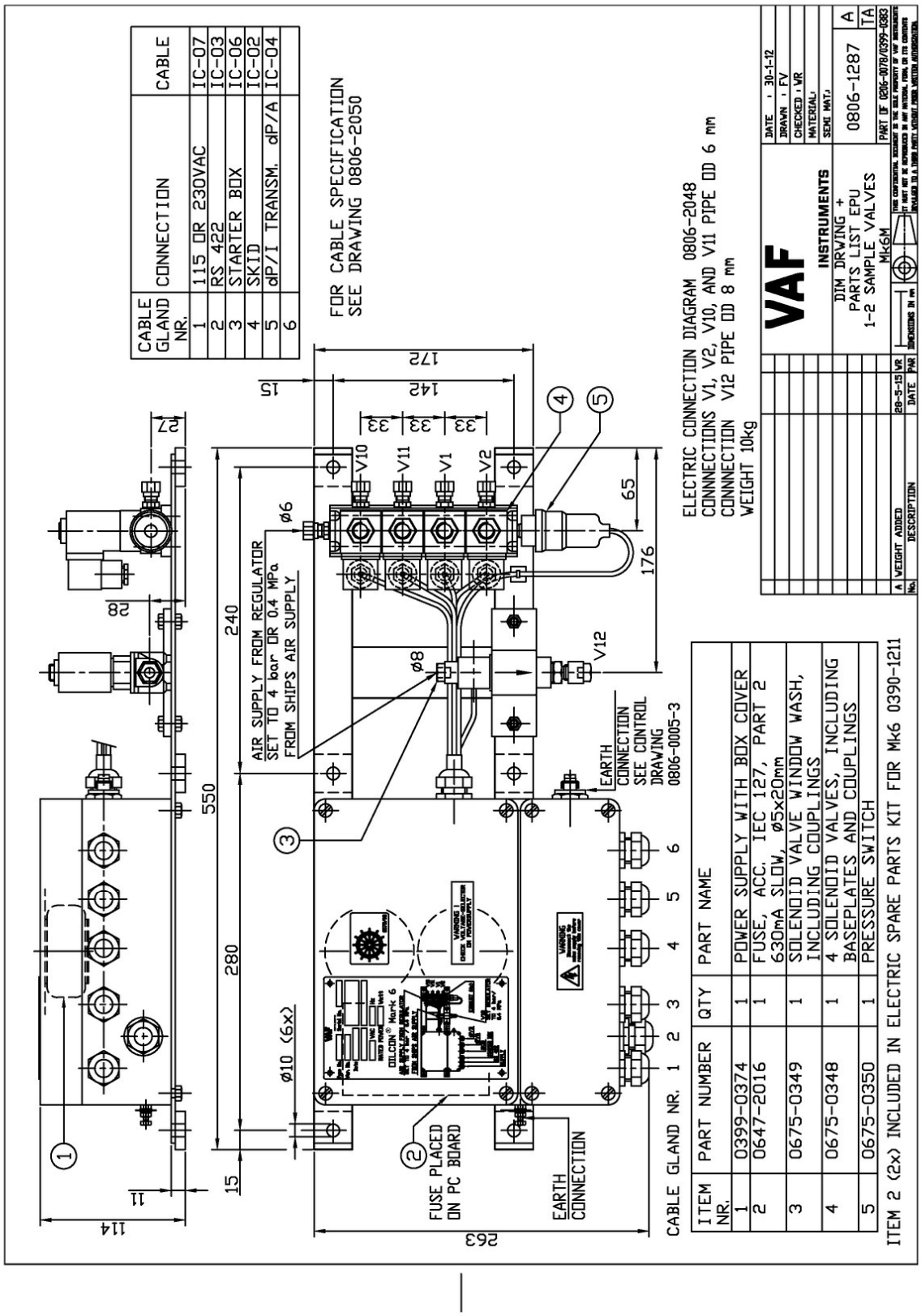


Drawing 13 – 0806-1285

ITEM No.	NAME AND No. SPARE PART	SKETCH SPARE PART DIMENSIONS mm	MATERIAL	SUPPLY		PARTS LIST	
				WORKING	SPARE	ITEM No.	DRAW. No.
(1)	BOX SPARE PARTS 0499-0531		SYNTHETIC		1		
(4)	O-RING 0630-3034		VITON	2	2	1	DETECTOR CELL BALLAST SKID 0806-1271-4
(5)	BOTTLE WITH 0.5 LITRE OIL		HYDRAULIC OIL		1		SAMPLE PUMP 0806-1260-3
(6)	CLEANING BRUSH				1		DETECTOR CELL BALLAST SKID 0806-1271-4
(7)	FUSE 630mA SLOW			1	2	2	ELECTRO PNEUMATIC UNIT 0806-1263-3

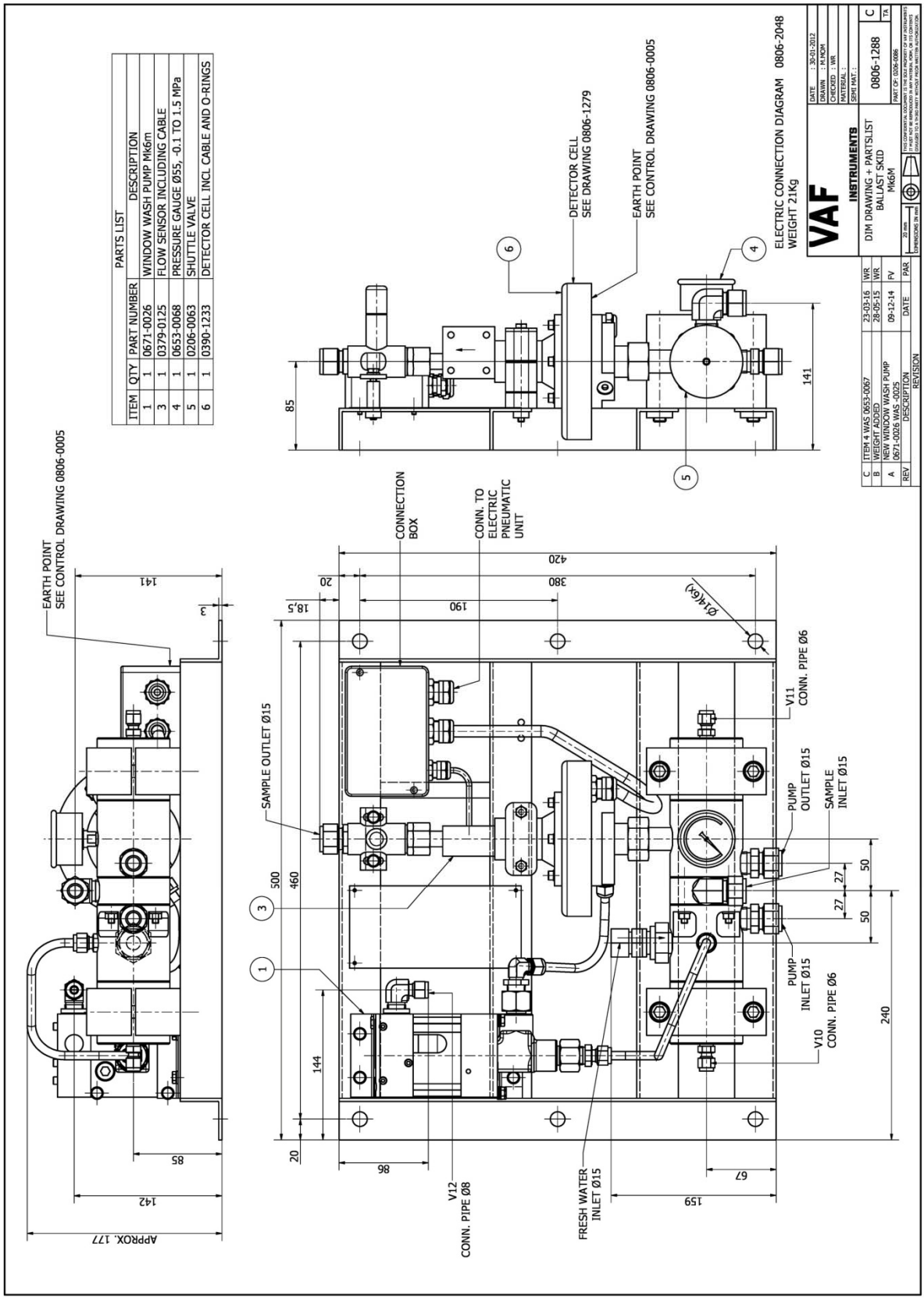
				DATE	: 8-12-11
				DRAWN	: Regeer
				CHECKED	: wR
				MATERIAL	: -
			VAF INSTRUMENTS	SEMI MAT.	: -
			BASIC SPARE PARTS KIT BALLAST MONITOR Mk6M 0390-1301	0806-1286	A
				PART OF	TIB
A	ITEM 8 FUSE 500mA DELETED	30-1-12	WR	DIMENSIONS IN mm	
No.	DESCRIPTION	DATE	PAR		

Drawing 14 – 0806-1286

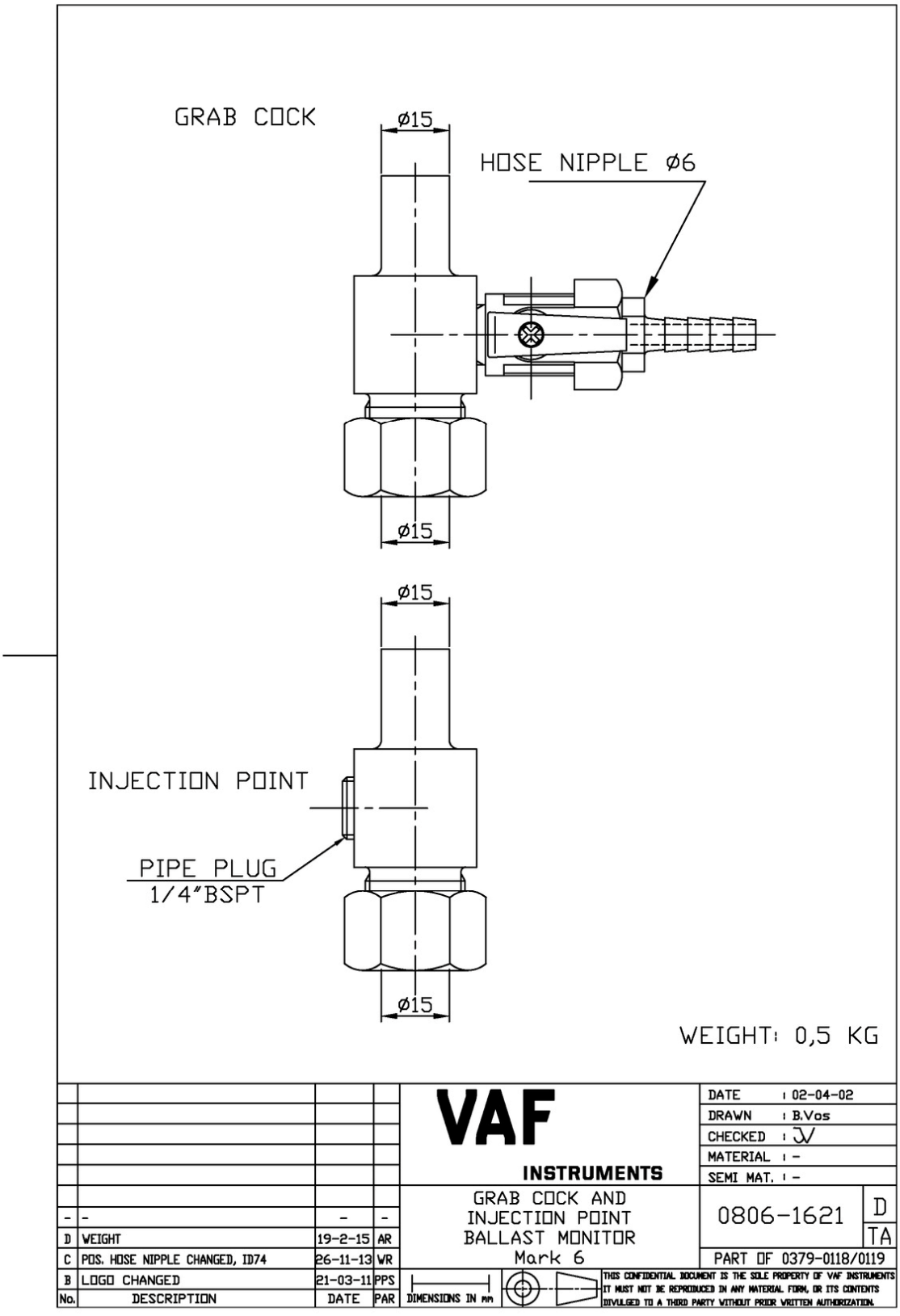


ITEM NR.	PART NUMBER	QTY	PART NAME
1	0399-0374	1	POWER SUPPLY WITH BOX COVER
2	0647-2016	1	FUSE, ACC. IEC 127, PART 2 630mA SLOW, ø5x20mm
3	0675-0349	1	SOLENOID VALVE WINDOW WASH, INCLUDING COUPLINGS
4	0675-0348	1	4 SOLENOID VALVES, INCLUDING BASEPLATES AND COUPLINGS
5	0675-0350	1	PRESSURE SWITCH

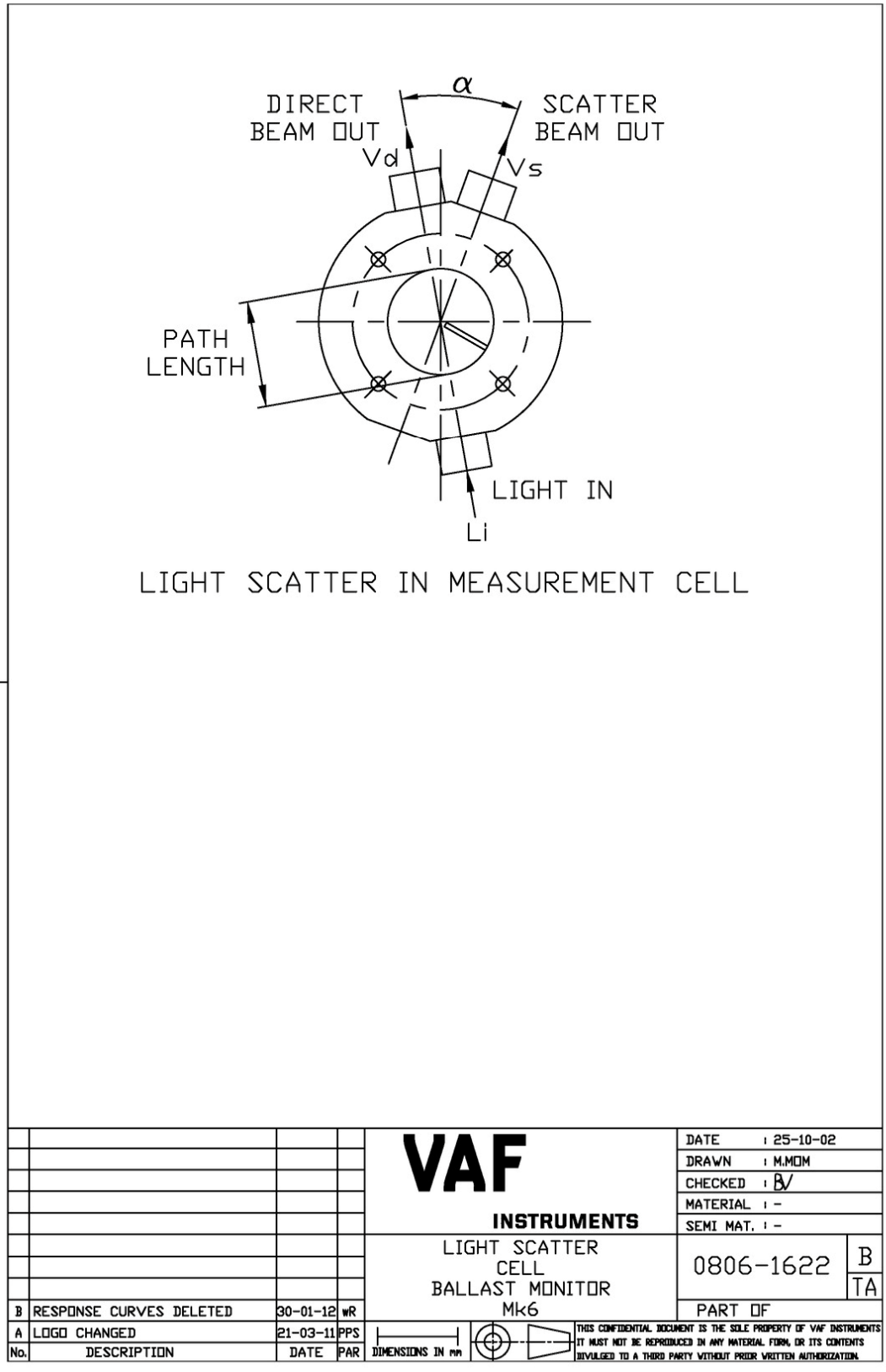
Drawing 15 – 0806-1287



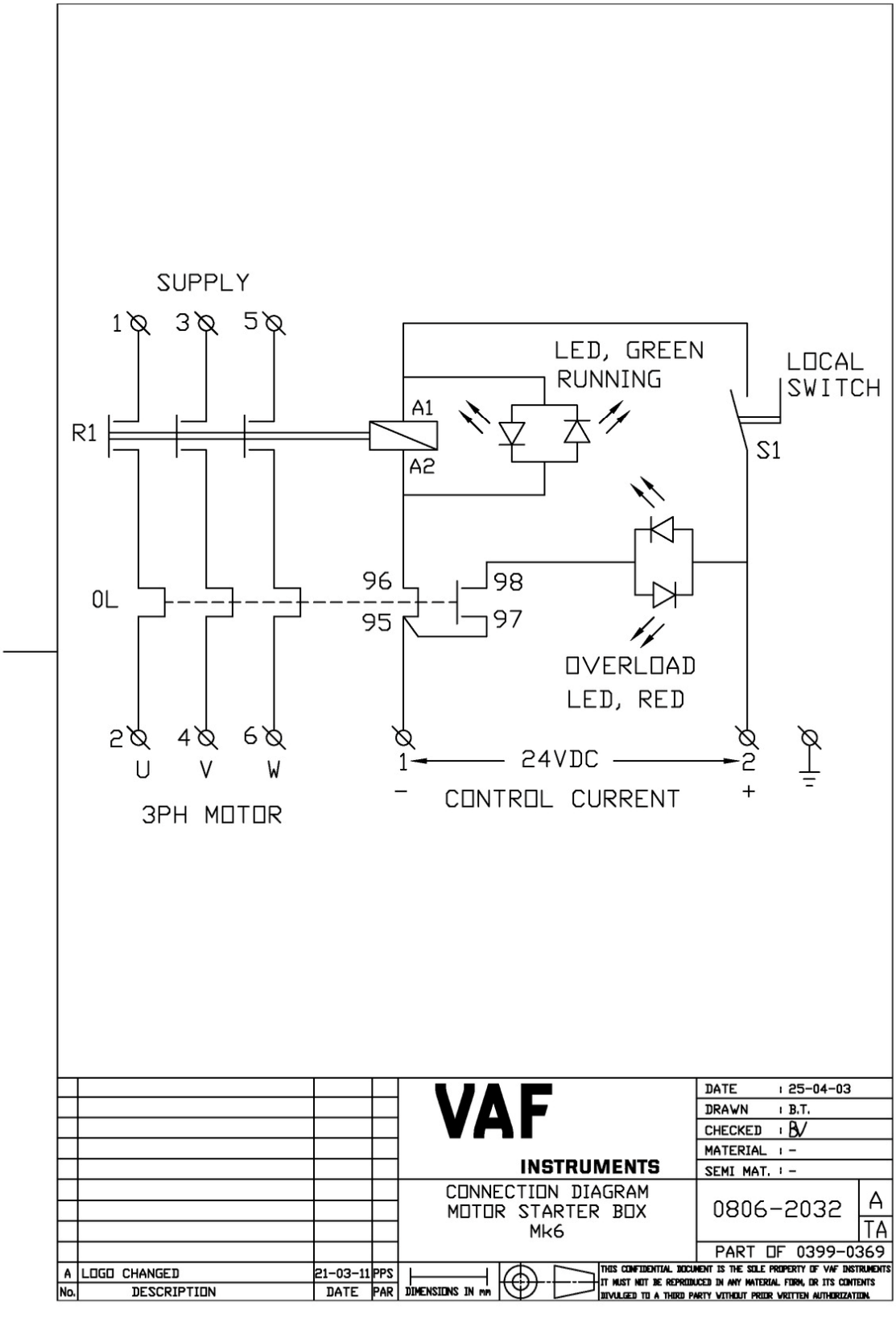
Drawing 16 – 0806-1288



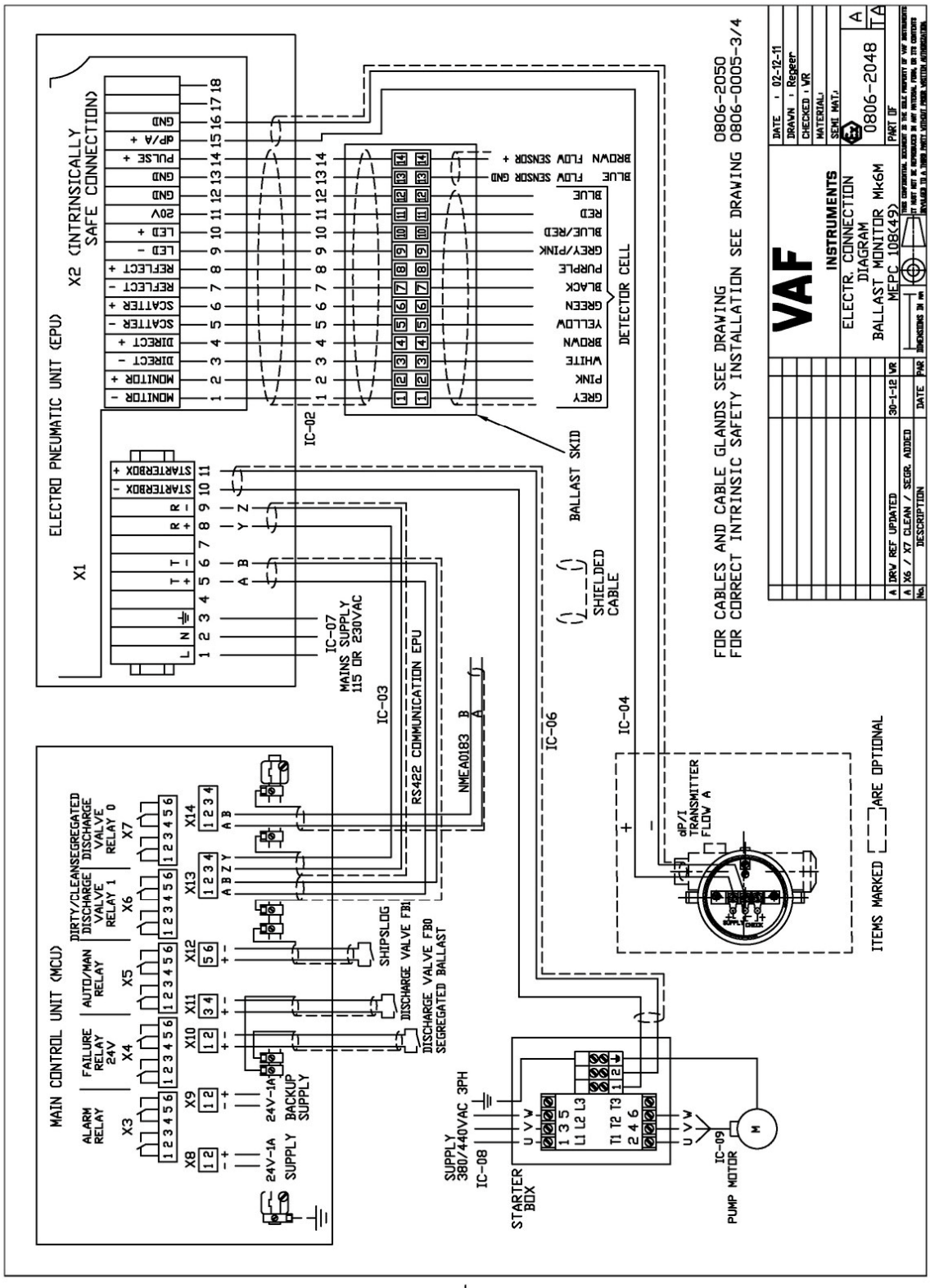
Drawing 17 – 0806-1621



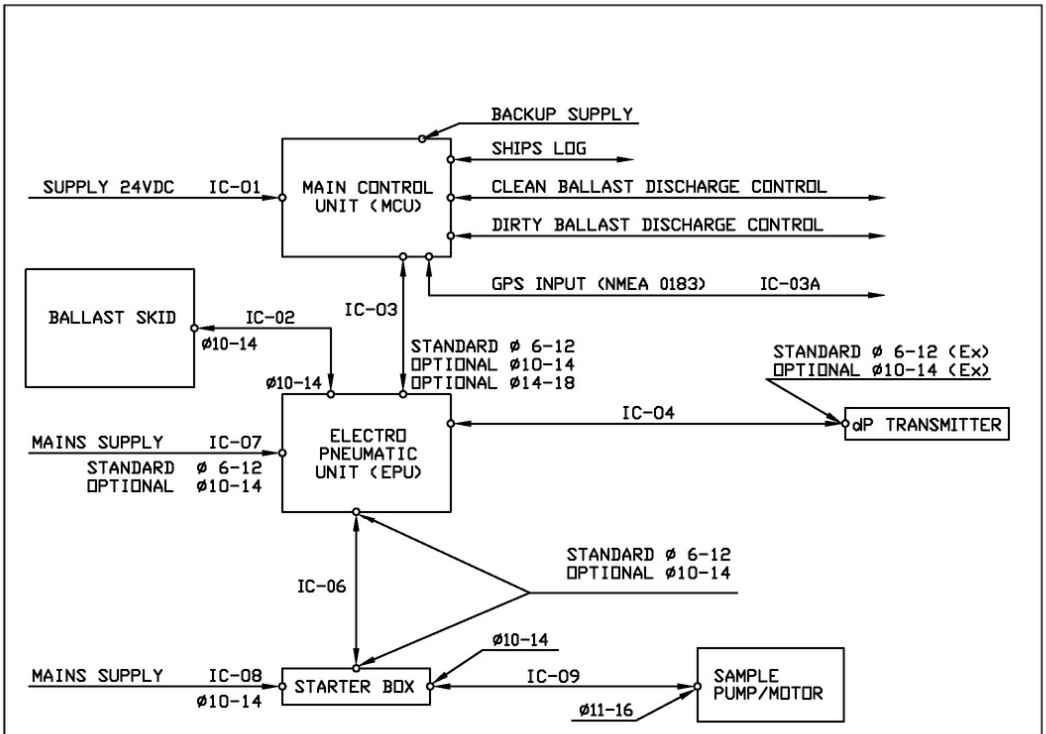
Drawing 18 – 0806-1622



Drawing 19 – 0806-2032



Drawing 20 – 0806-2048



CABLE SPECIFICATION

No. OF CORES/SIZE

IC-01: 2x0.5 mm2

IC-02: 7x2x0.5 mm2 (7x2 TWISTED PAIR OVERALL BRAIDED SCREENED
E.G. HELKAMA RFE-HF60V) VAF Nr. R60-60-231

IC-03: 2x2x0.5 mm2 (2x2 PAIR INDIVIDUAL SCREENED
E.G. BELDEN 9842) VAF Nr. R60-60-229

IC-03A: 2x0.5 mm2 (ONE PAIR SCREENED CABLE) ACC. SPEC. 0960-0679

IC-04: 2x0.5 mm2 (2 TWISTED PAIR OVERALL BRAIDED SCREENED

IC-06: 2x0.5 mm2 E.G. JOBARCOFLEX IKPPOV-af) VAF Nr. R60-60-224
(ONE PAIR SCREENED CABLE)

IC-07: 3x0.75 mm2

IC-08: 4x2.5 mm2

IC-09: 4x2.5 mm2

USE APPROVED FLAME RETARDING CABLE
IF WIRES ARE LED THROUGH THE BULKHEAD (MCT)
IC-02: 10 m OF CABLE IS PART OF SCOPE OF SUPPLY (MAX LENGTH. 30 m)

No.	DESCRIPTION	DATE	PAR
C	CABLE GLAND INFO UPDATED	13-11-15	WR
B	ADDED CABLE LENGTH IC-02	14-1-14	AR
A	SUPPLY MCU CORRECTED	13-3-13	WR

VAF INSTRUMENTS

CONNECTION DIAGRAM
OILCON Mark 6
CABLE SPEC. MEPC 108(49)

DATE : 30-1-12
DRAWN : FV
CHECKED : FV
MATERIAL:
SEMI MAT.:

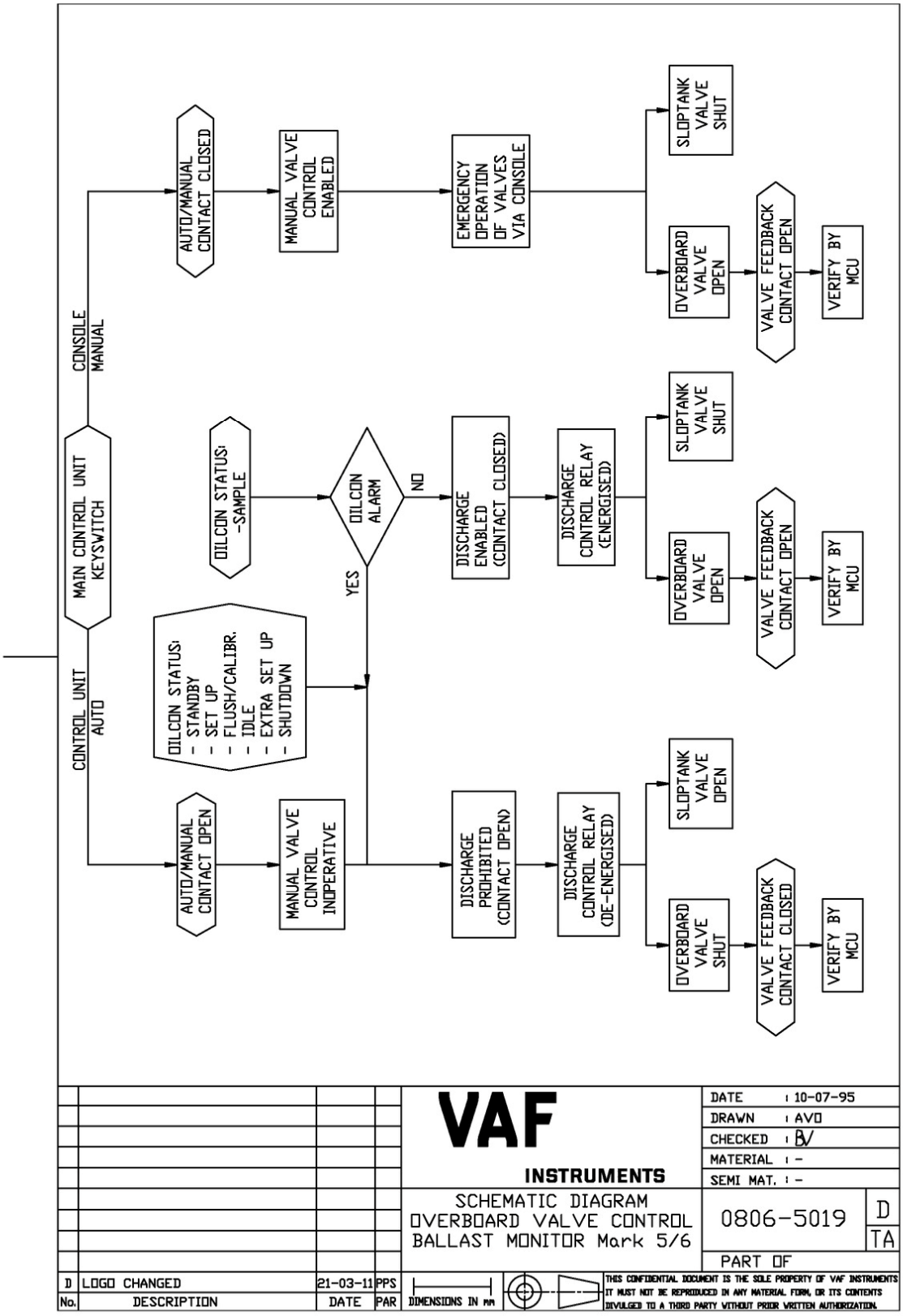
0806-2050 C

TIB

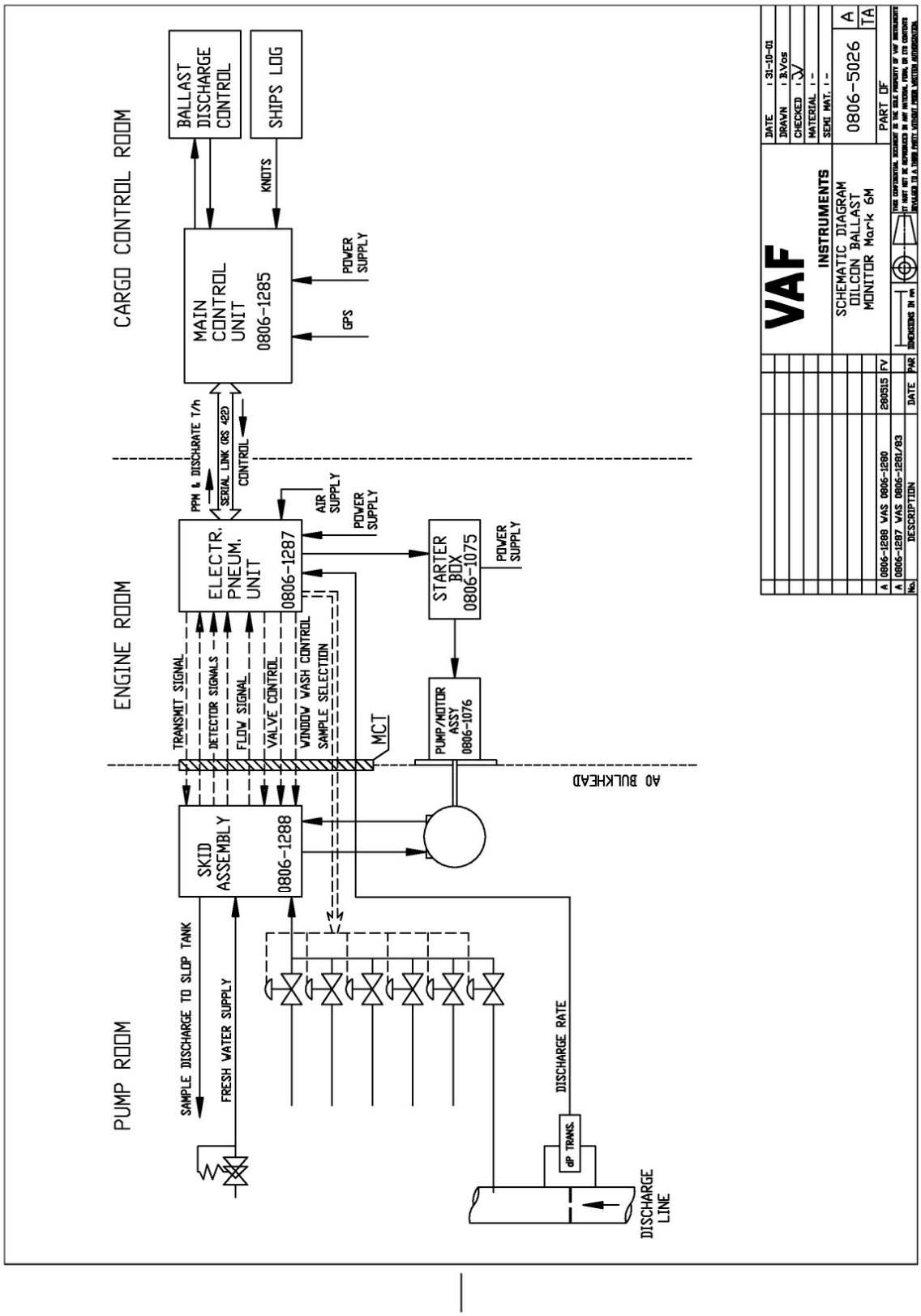
PART OF

DIMENSIONS IN mm

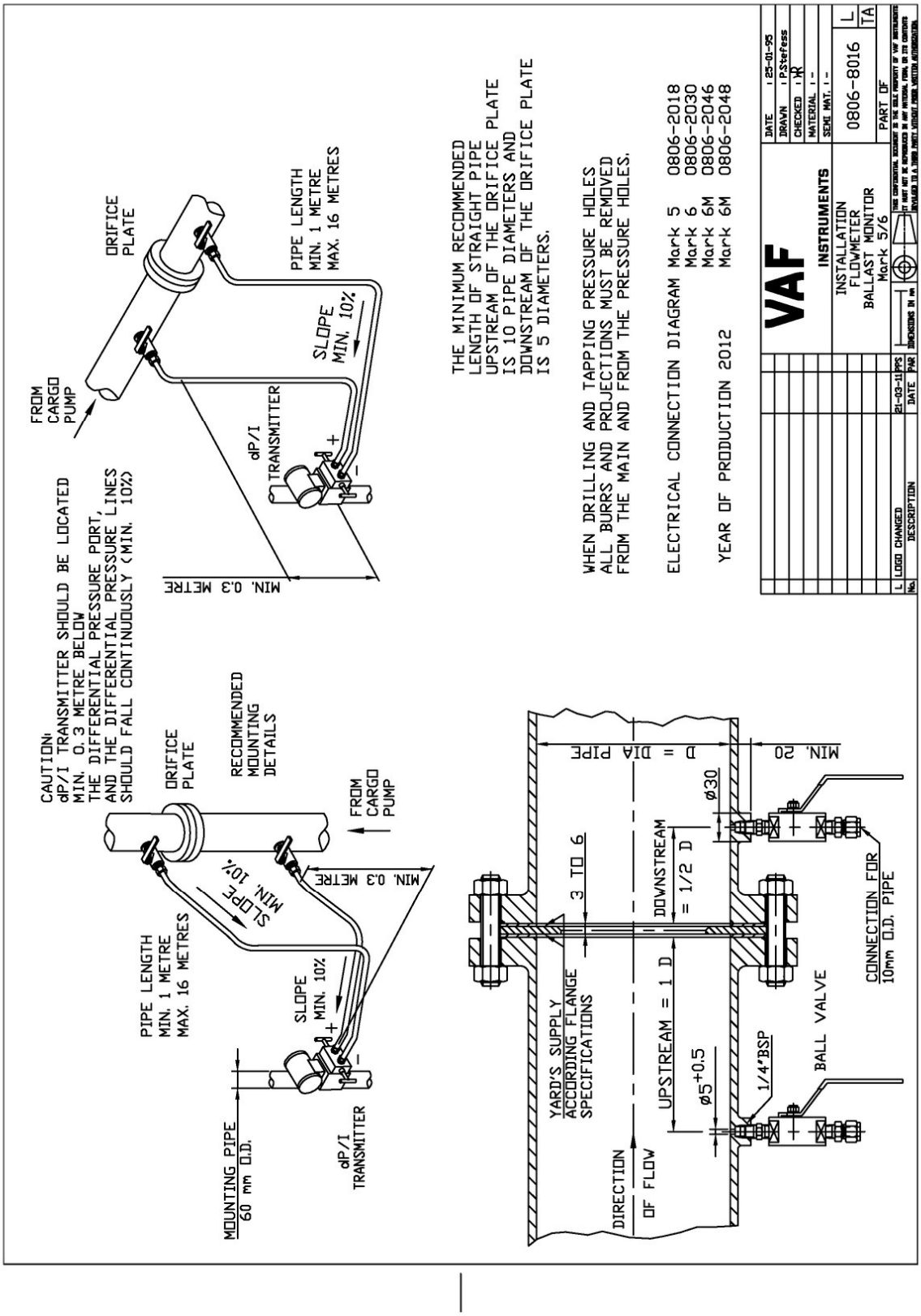
Drawing 21 – 0806-2050



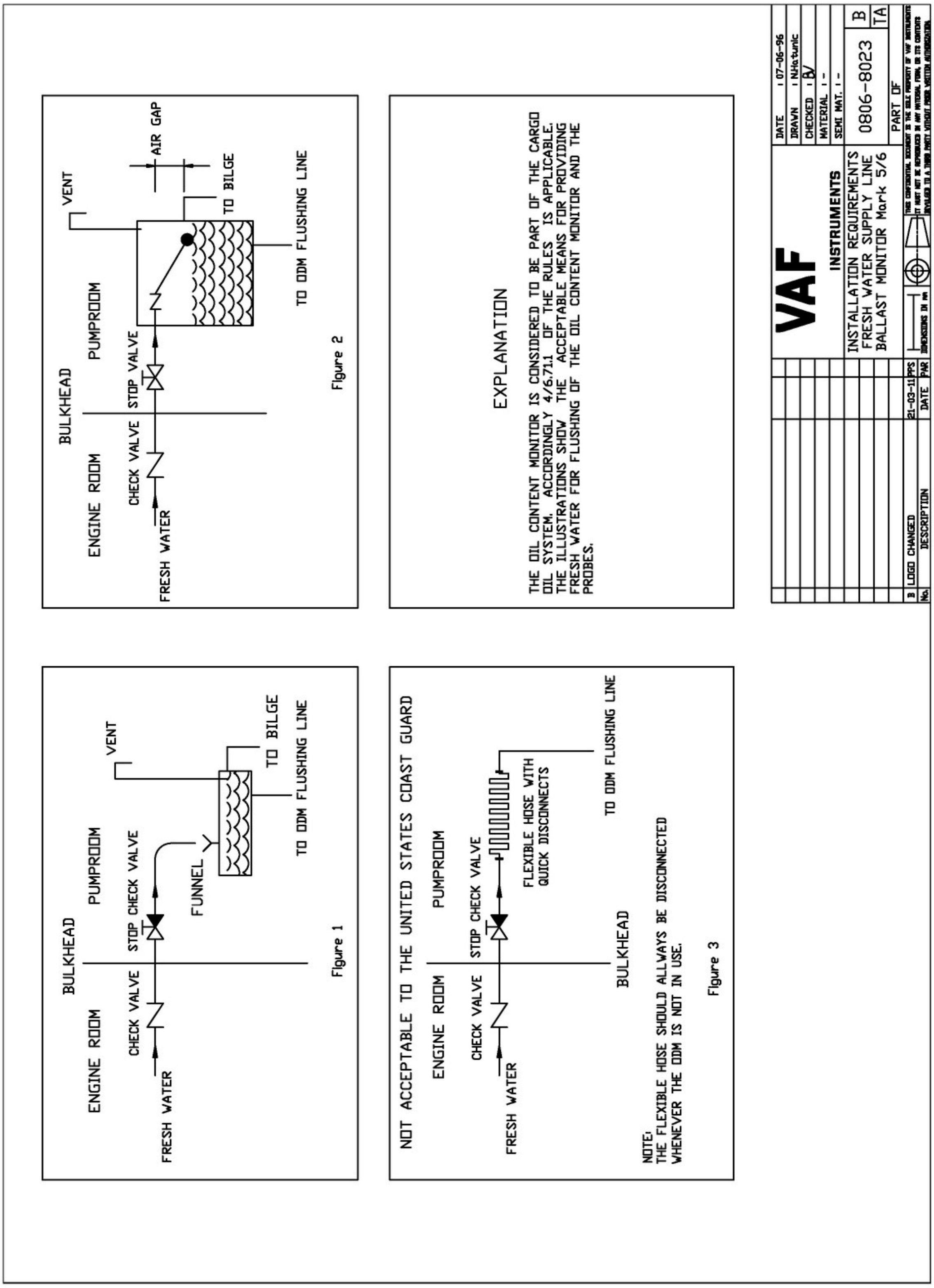
Drawing 22 – 0806-5019



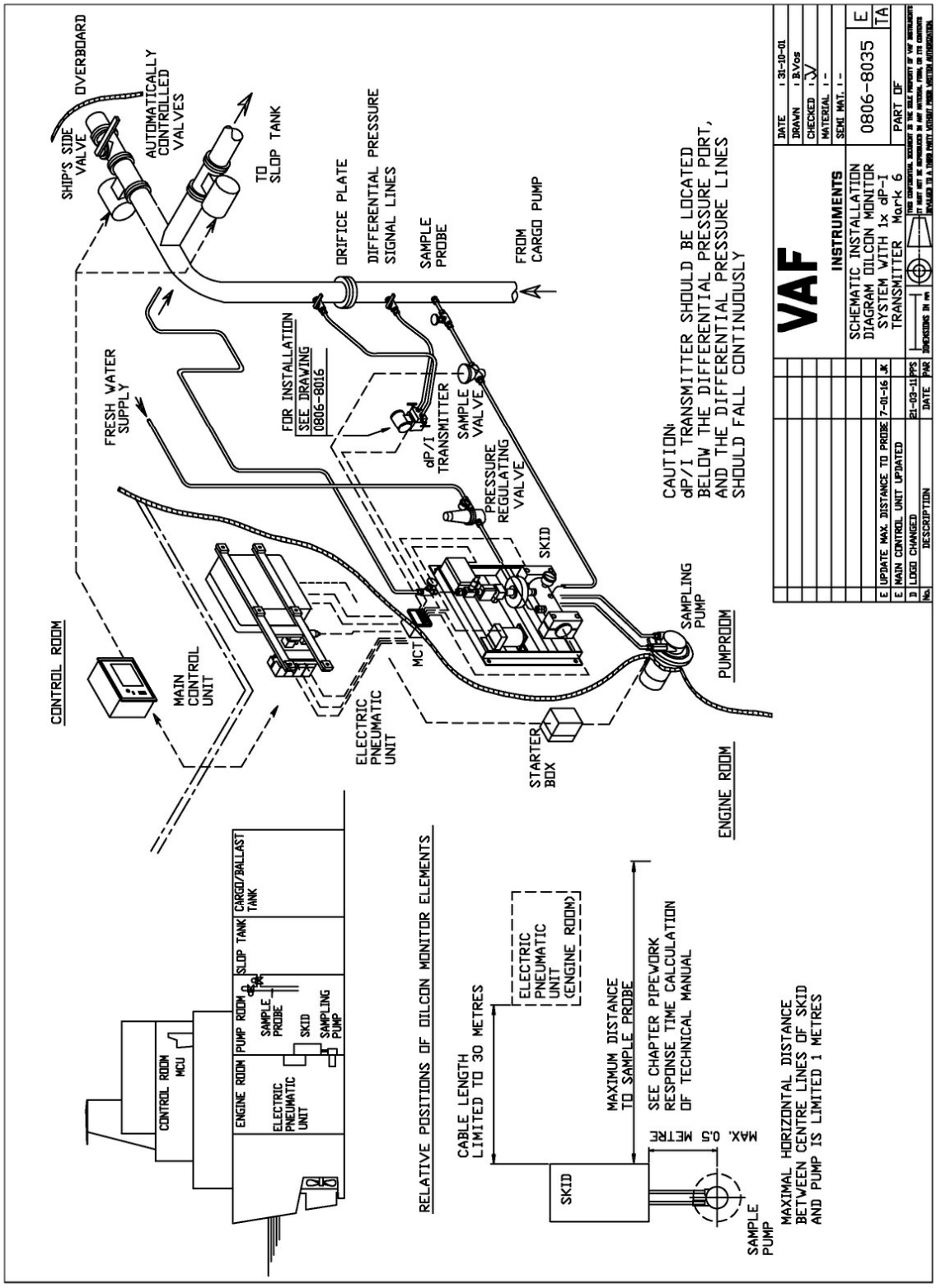
Drawing 23 – 0806-5026



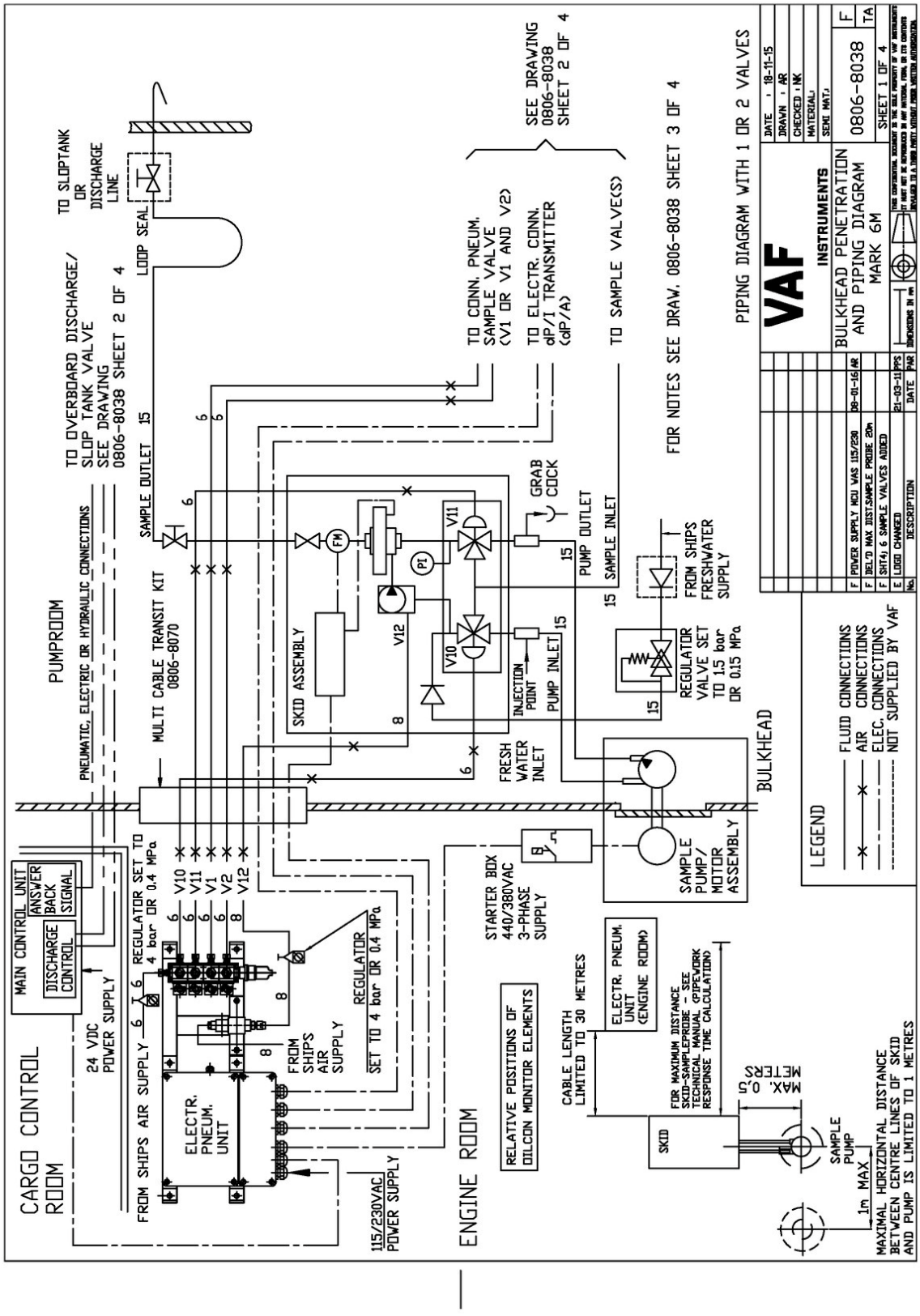
Drawing 24 – 0806-8016



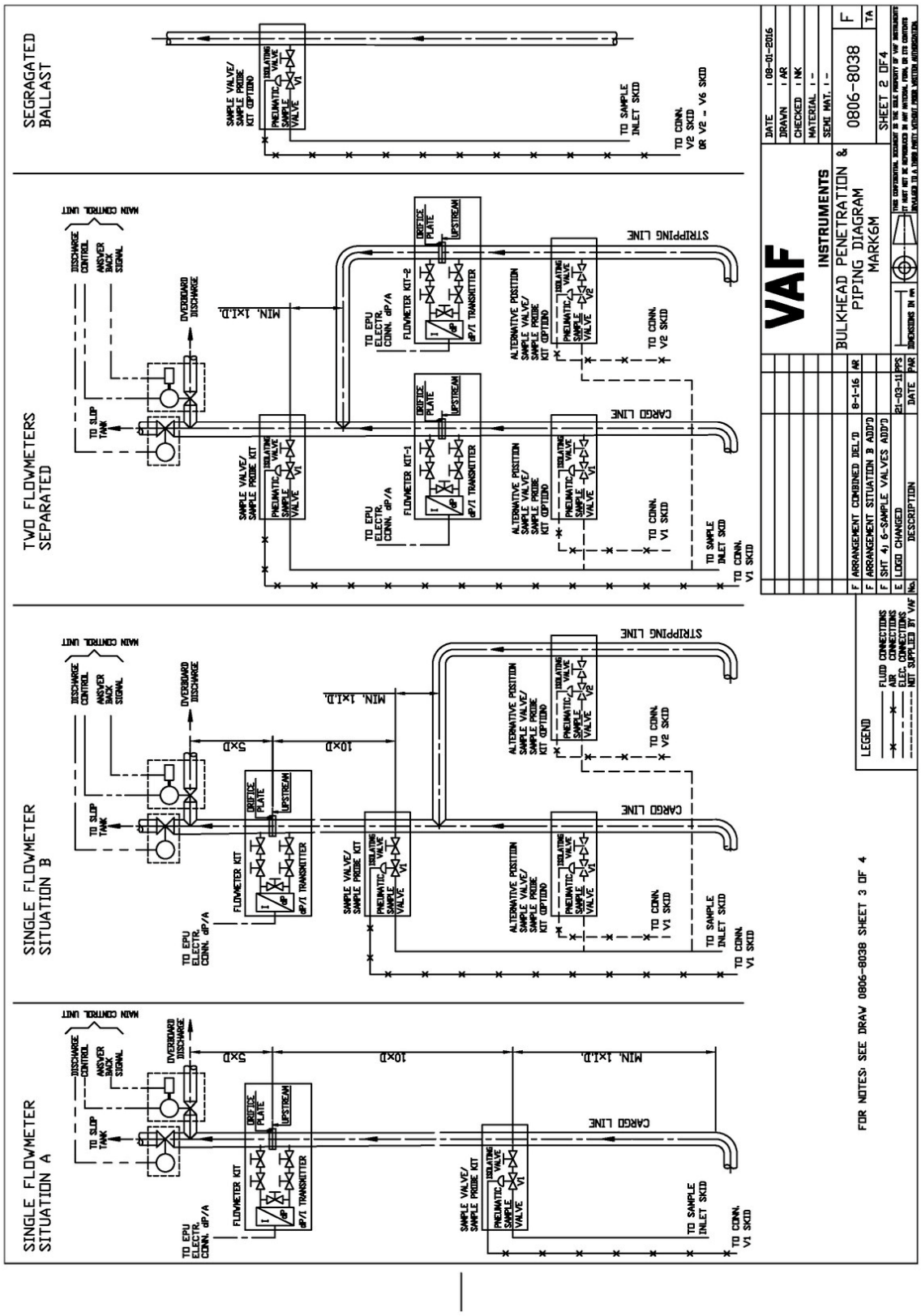
Drawing 25 – 0806-8023



Drawing 26 – 0806-8035



Drawing 27 – 0806-8038 – Sheet 1/4



Drawing 28 – 0806-8038 – Sheet 2/4

NOTES:

1. ALL DIMENSIONS ARE MILLIMETERS.
   PIPE SIZES ARE O. D.

2. ALL PNEUMATIC PIPES, MATERIAL COPPER
   ALL WATERSERVICE PIPES, OF A SUITABLE MATERIAL.

3. ALL 6mm AND 8mm FITTINGS ON SKID AND
   ELECTRIC PNEUMATIC UNIT ARE SUPPLIED.
   ALSO ONE 6mm FITTING FOR SAMPLE VALVE.

4. OTHER PIPE FITTINGS ARE SUPPLIED AS FOLLOWS :
   -PUMP SUCTIONS AND DELIVERY (2x)
   -SKID CONNECTIONS FOR PUMP (2x)
   -MANUAL ISOLATING VALVE ON SKID (1x)
   -PNEUMATIC SAMPLE VALVE (2 PER VALVE)
   -INJECTION POINT (1x)
   -GRAB COCK (1x)

5. SHIP'S CONTROL AIR SUPPLY TO BE CLEAN, DRY AIR,
   MIN. PRESSURE 0. 6MPa (6 bar), MAX. PRESSURE 1. 5MPa (15 bar).
   CONSUMPTION 50 L/min. AVERAGE CONSUMPTION 6 L/min.

6. SHIPS FRESH WATER SUPPLY TO BE FREE OF ANY CONTAMINANTS
   MAX. PRESS. 0. 6MPa (6 bar) NOM. PRESS. 0. 3MPa (3 bar).
   MAX. CONSUMPTION 8 L/min. (DURING FLUSH)
   AVERAGE CONSUMPTION 0. 25 L/min.

7. ALL PIPEWORK IS YARD SUPPLY.

8. ITEMS MARKED [ ] ARE YARD SUPPLY.

9. INSTALLATION PLACE OF FLOWMETER(S) AND SAMPLE POINT(S)
   MUST ALWAYS BE ARRANGED TO AVOID SYPHONING.

FOR PIPING DIAGRAM WITH:
1 OR 2 SAMPLE VALVES 0806-8038 SHEET 1 OF 4
3 TO 6 SAMPLE VALVES 0806-8038 SHEET 4 OF 4

No.	DESCRIPTION	DATE	PAR
E	REF.DWG. 6 SAMPLE VALVES CHG'D	08-01-16	AR
E	SHT 4: 6 SAMPLE VALVES ADDED		
D	LOGO CHANGED	21-03-11	PPS

VAF INSTRUMENTS

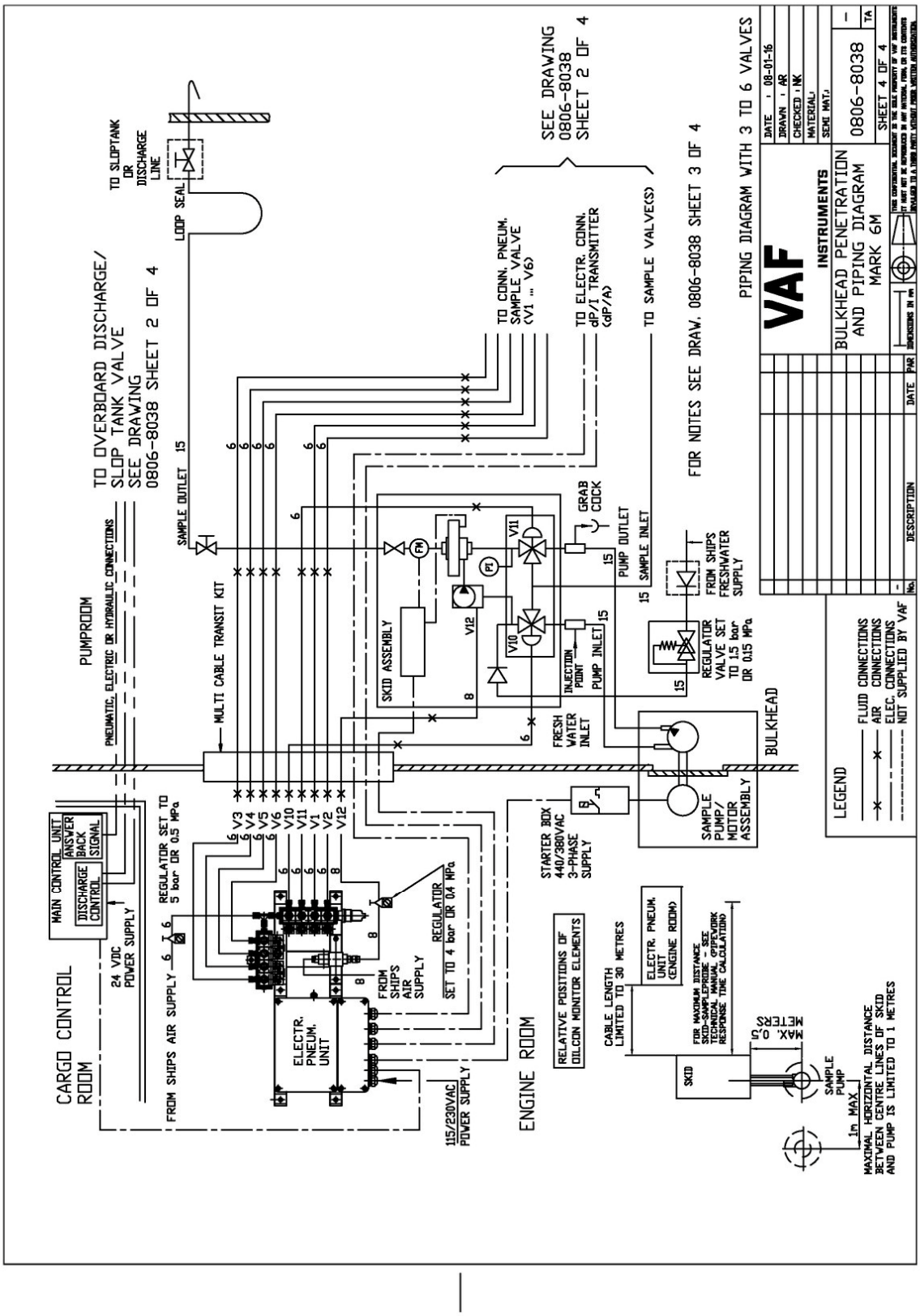
BULKHEAD PENETRATION AND PIPING DIAGRAM MARK6M

0806-8038 E TA

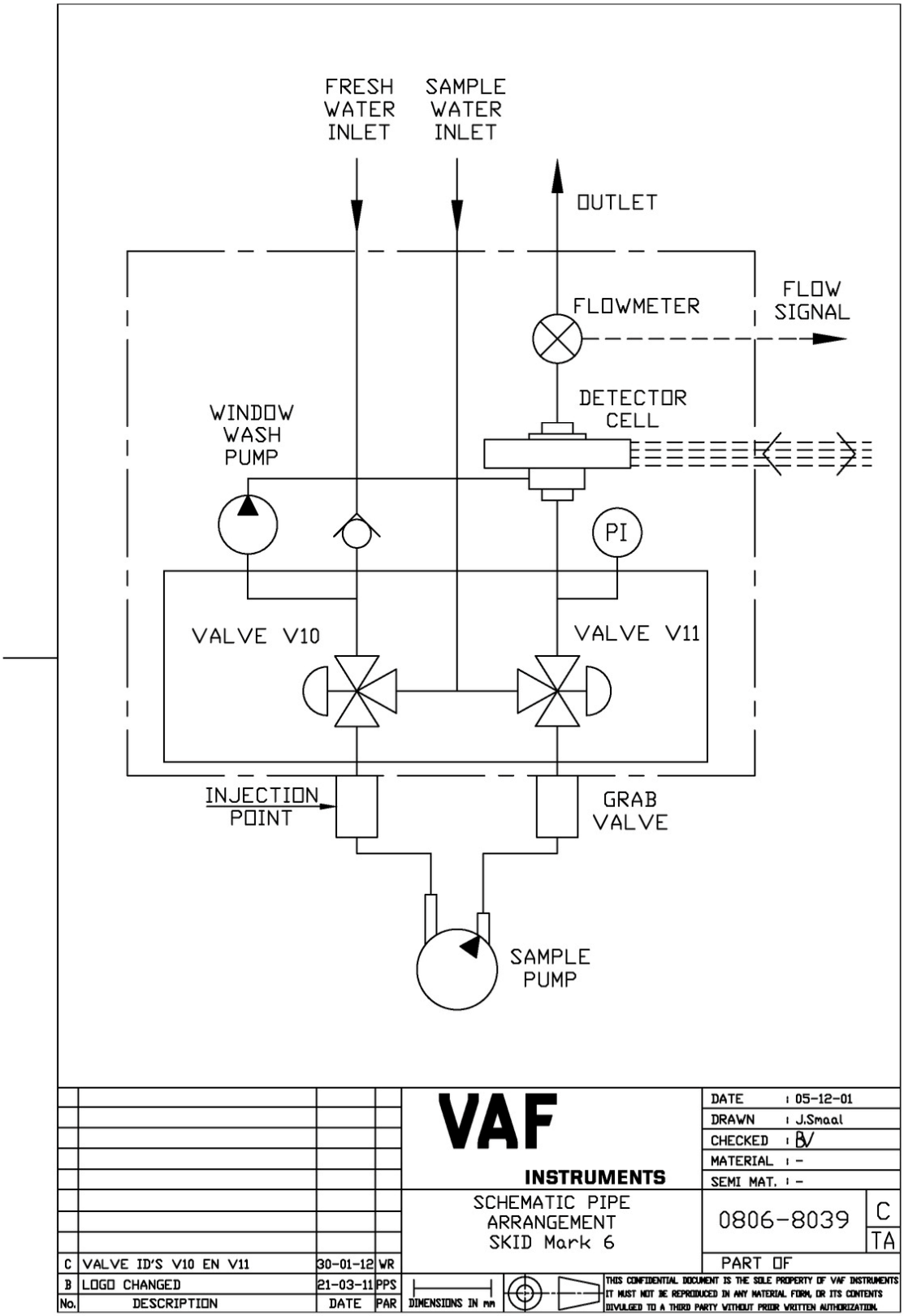
SHEET 3 OF4

DATE : 08-01-2016
DRAWN : AR
CHECKED : NK
MATERIAL : -
SEMI MAT. : -

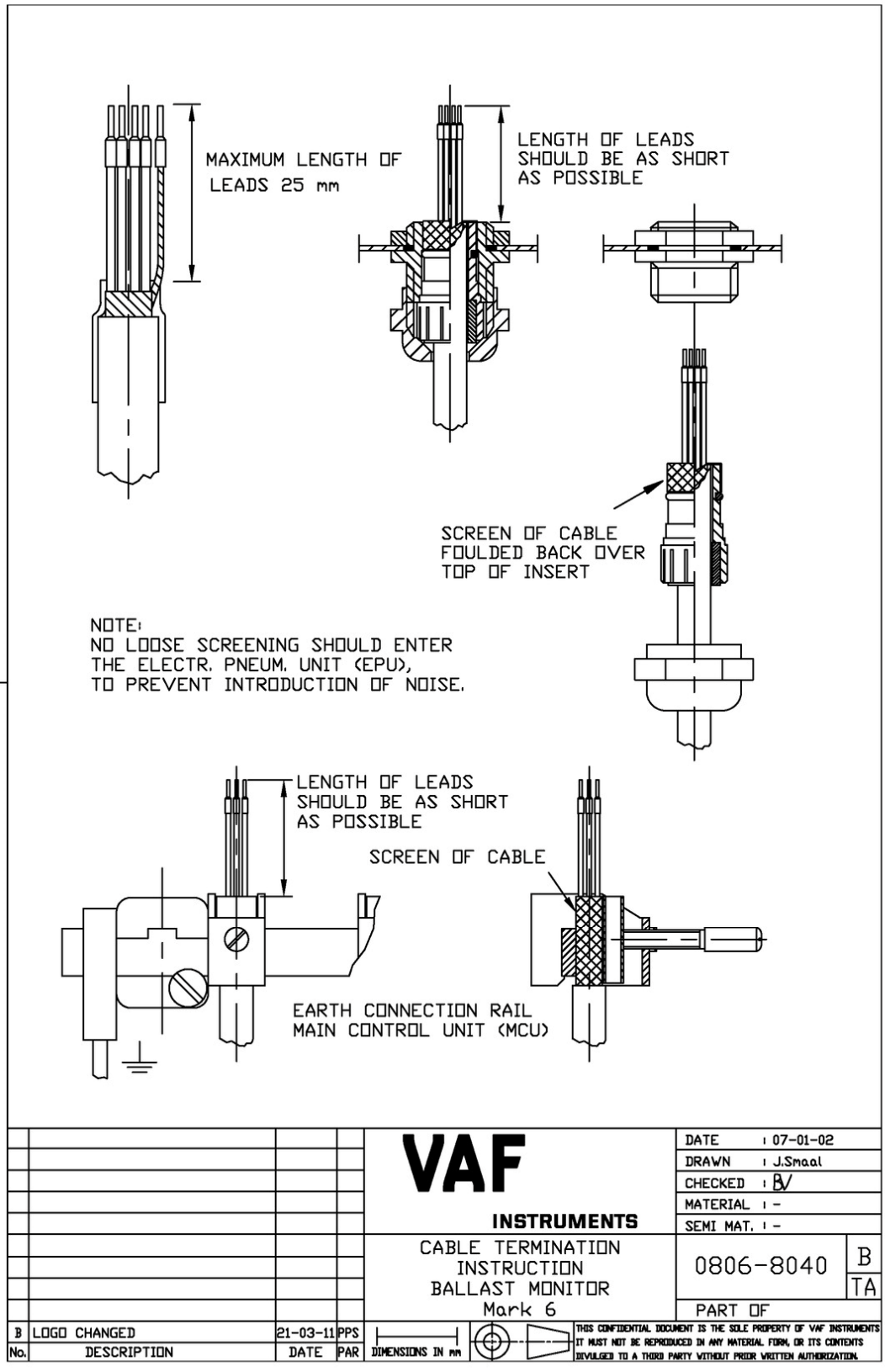
DIMENSIONS IN mm



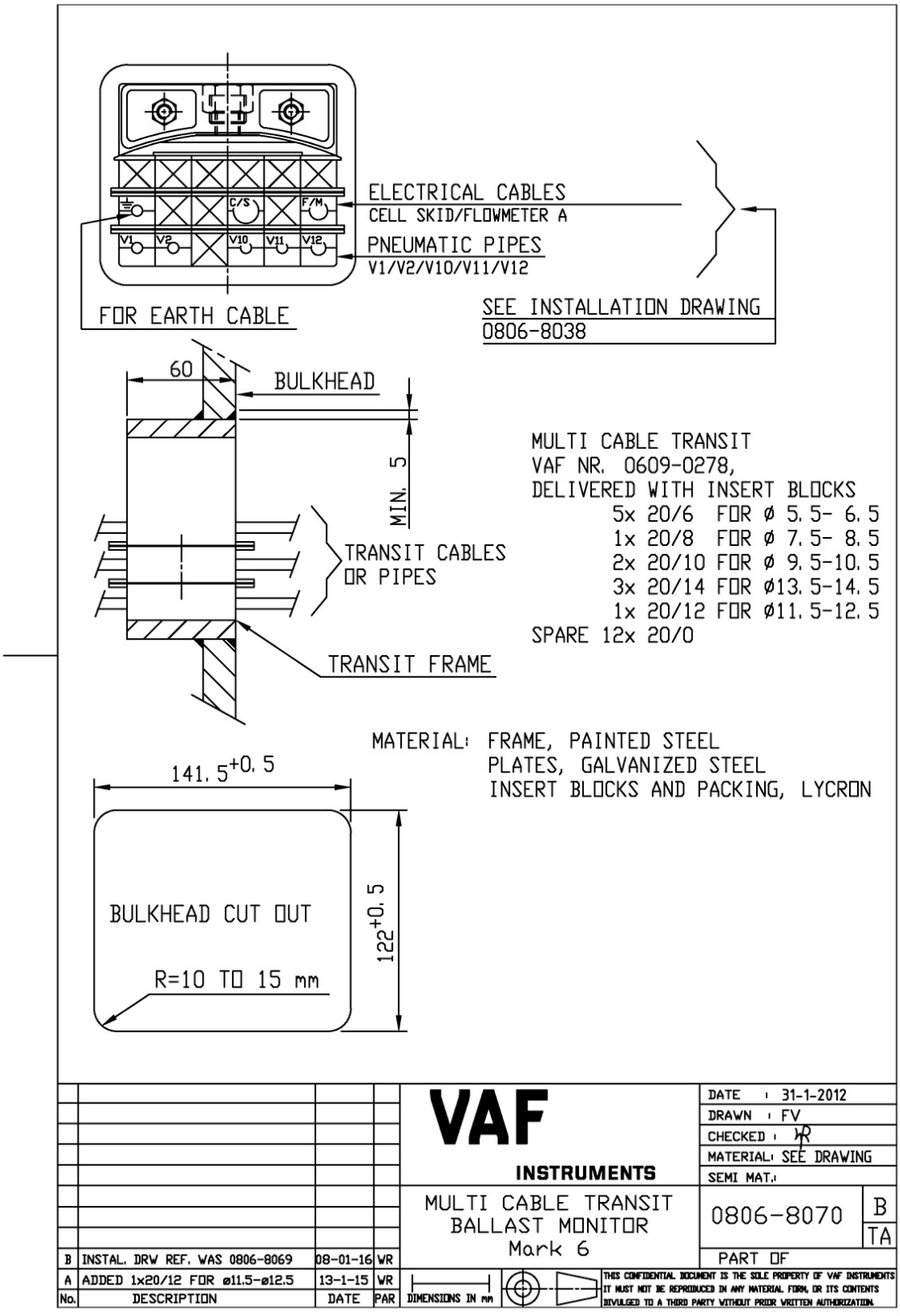
Drawing 30 – 0806-8038 – Sheet 4/4



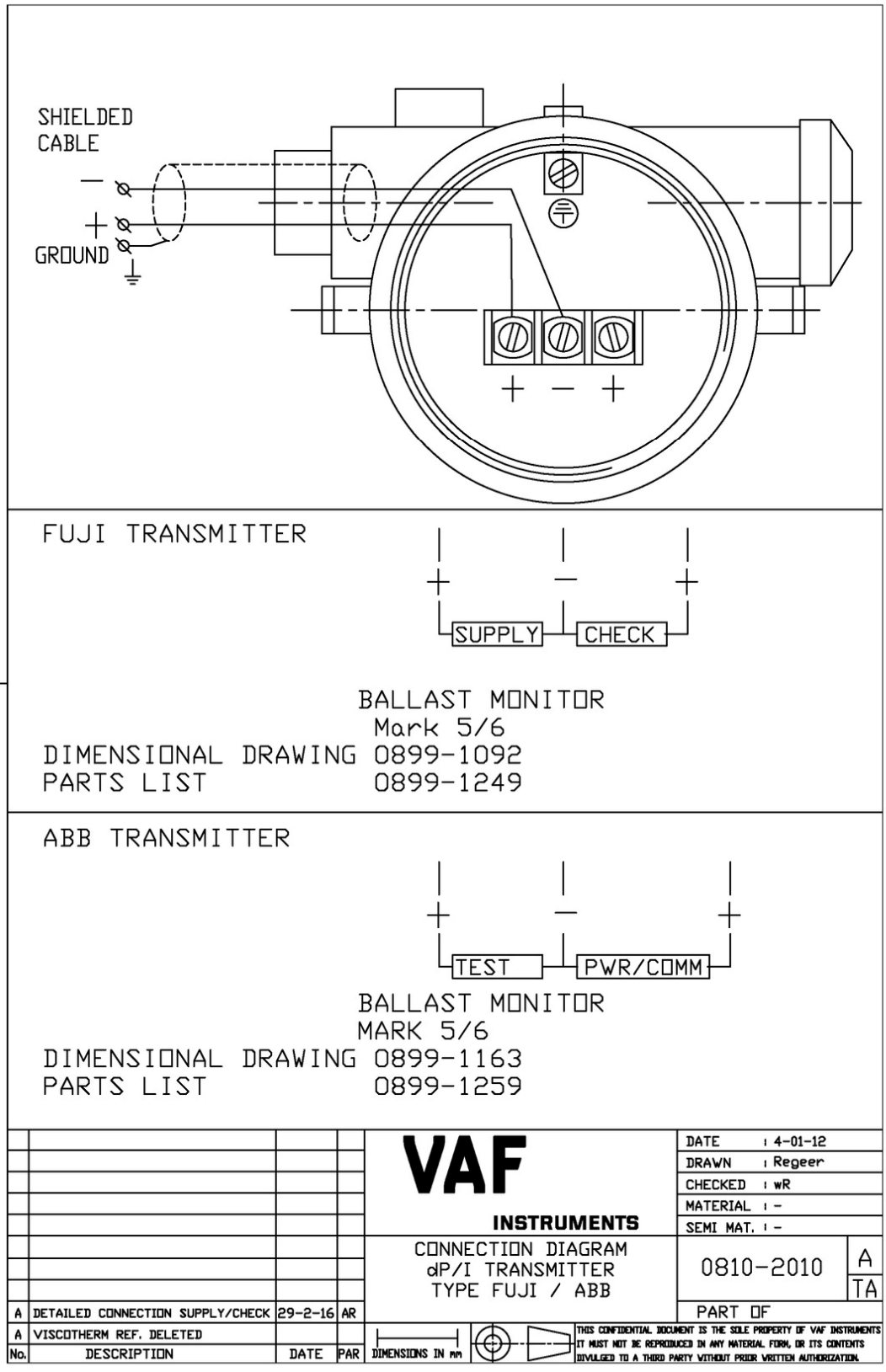
Drawing 31 – 0806-8039



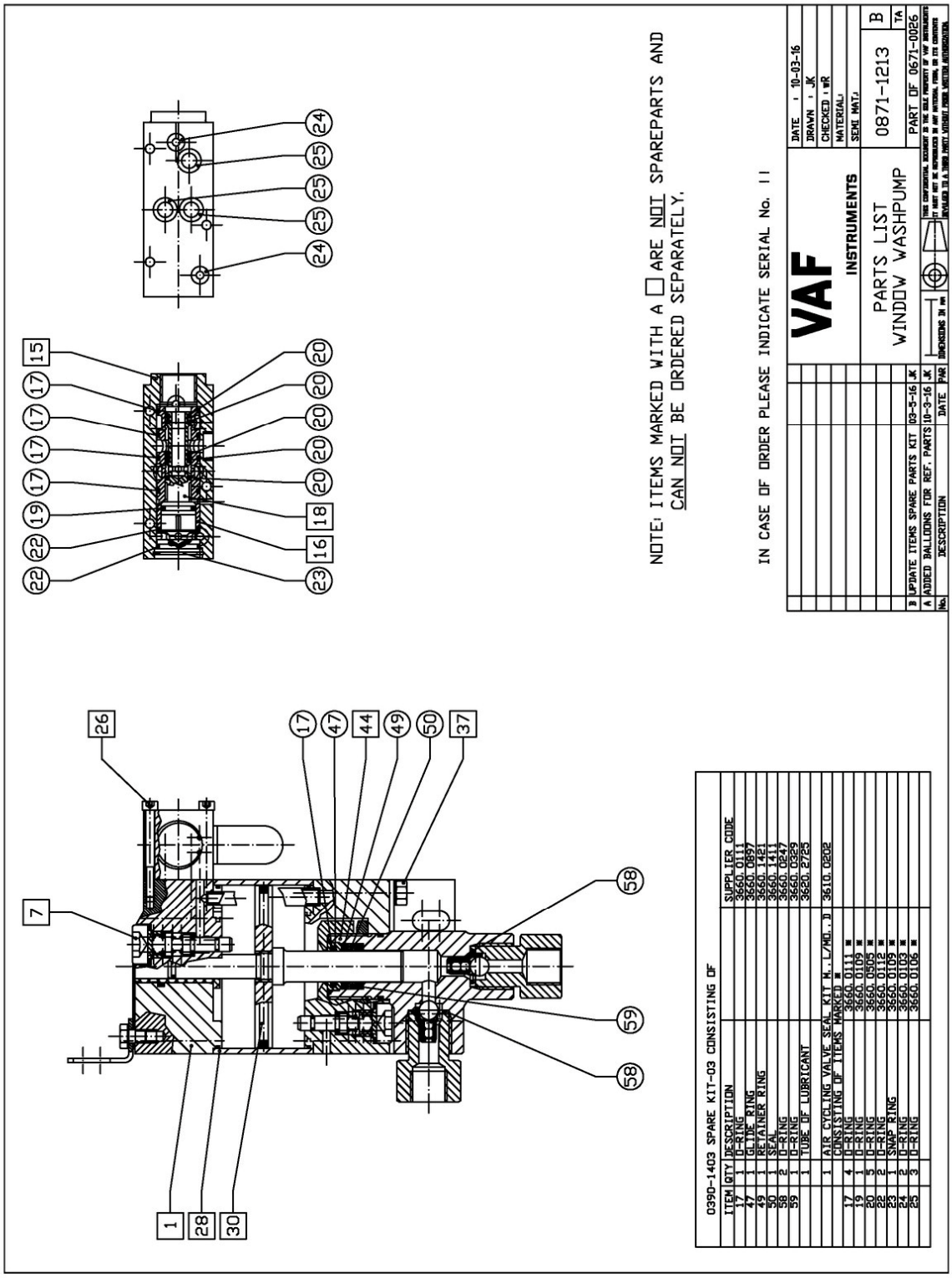
Drawing 32 – 0806-8040



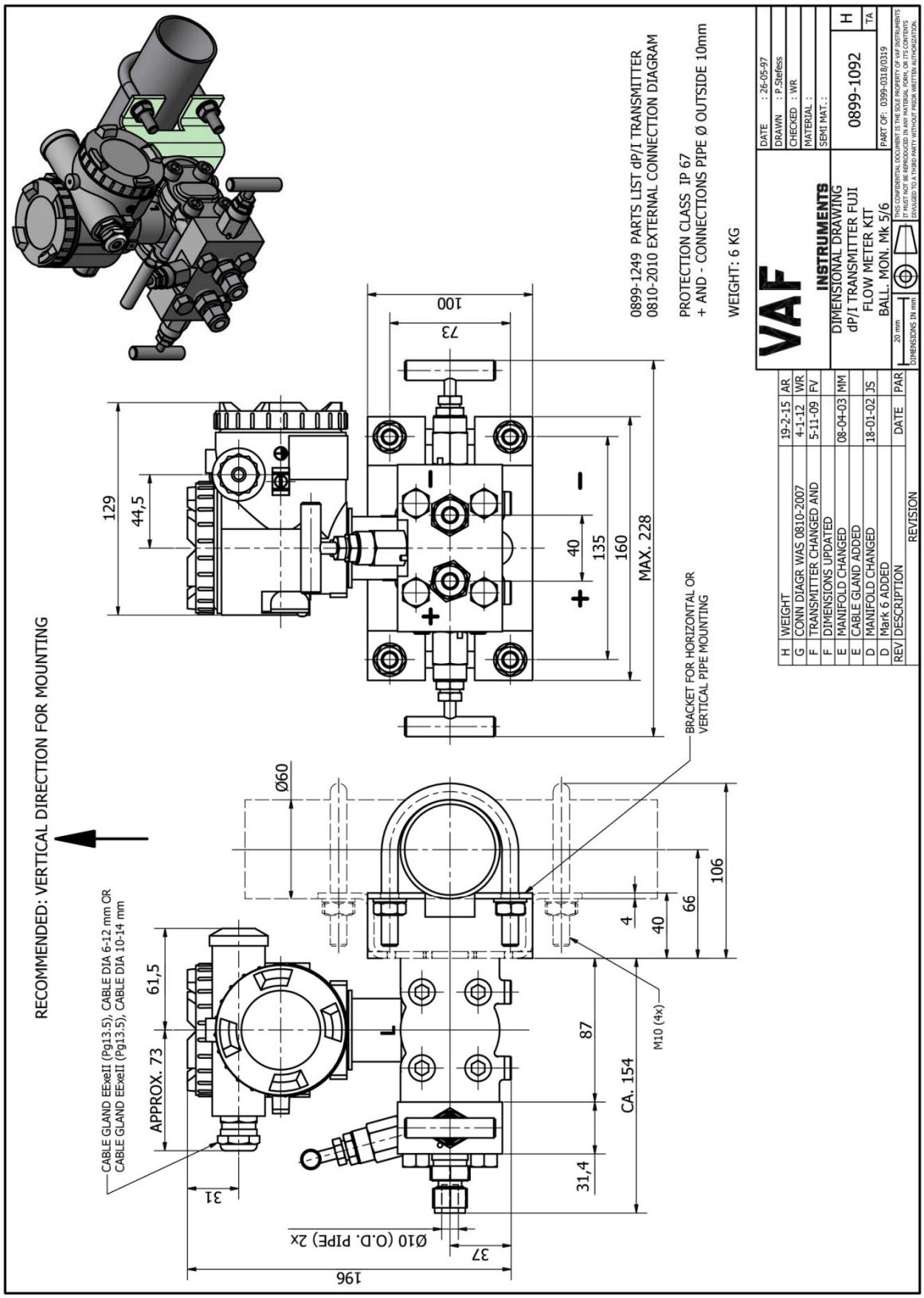
Drawing 33 – 0806-8070



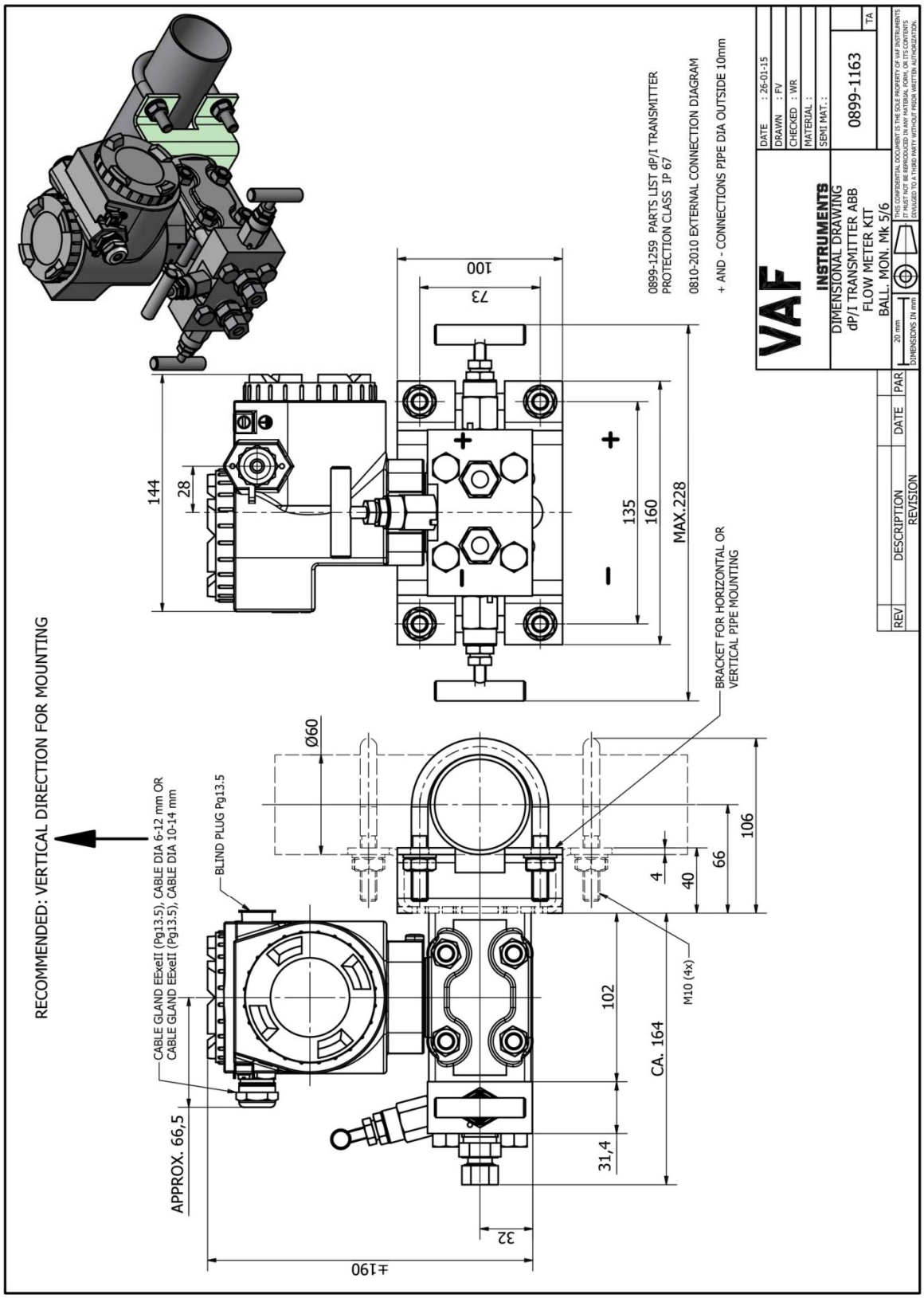
Drawing 34 – 0810-2010



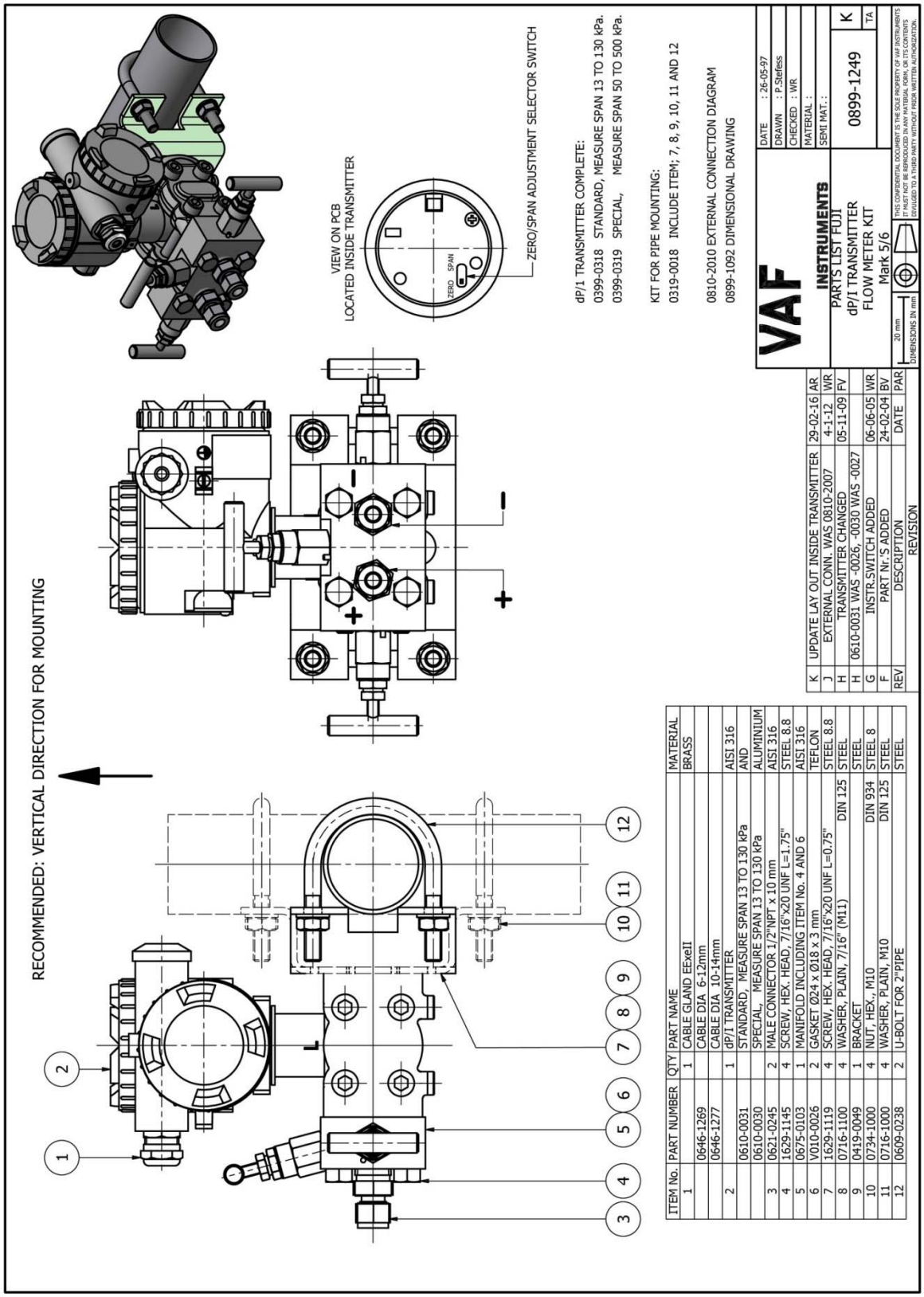
Drawing 35 – 0871-1213



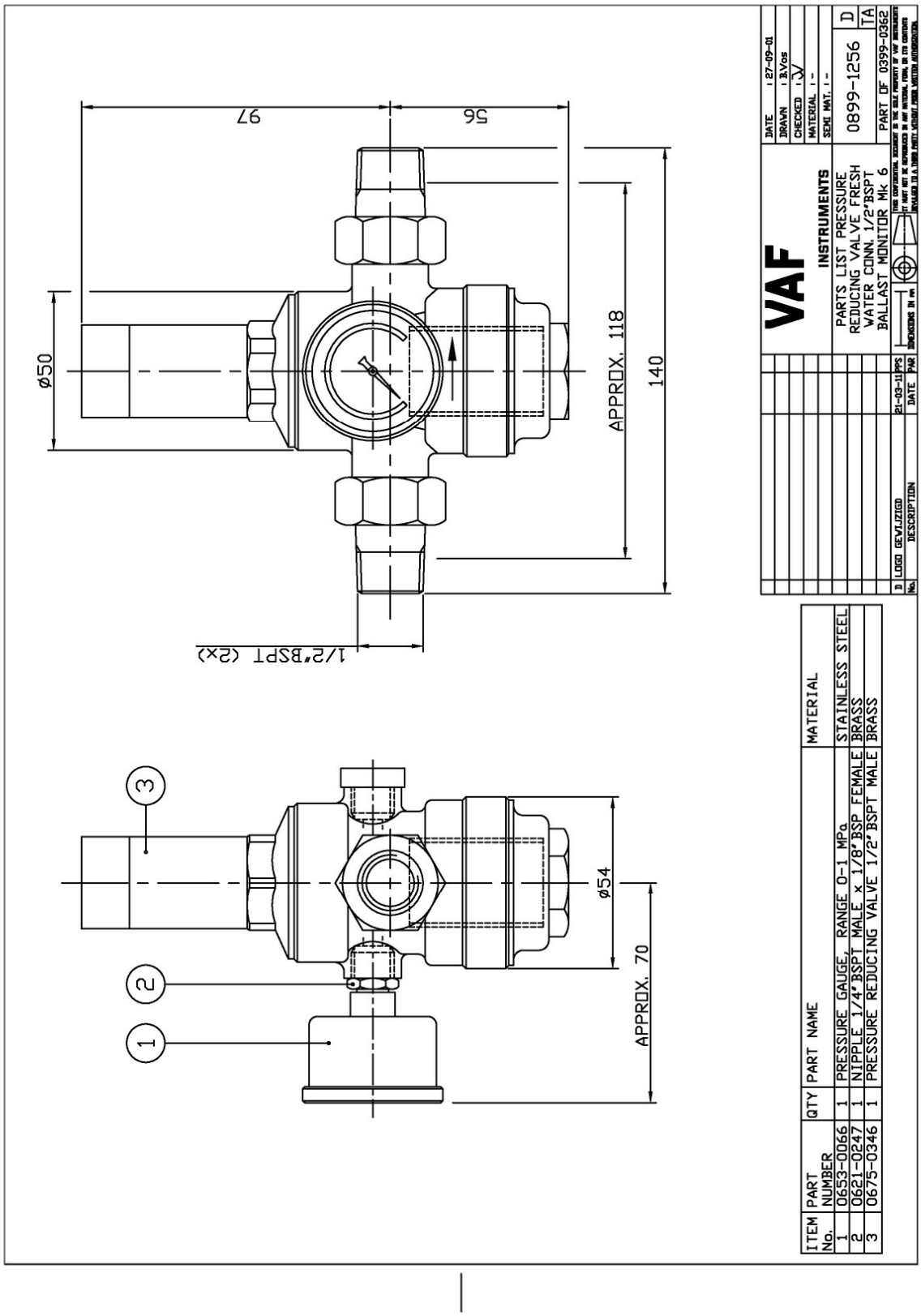
Drawing 36 – 0899-1092



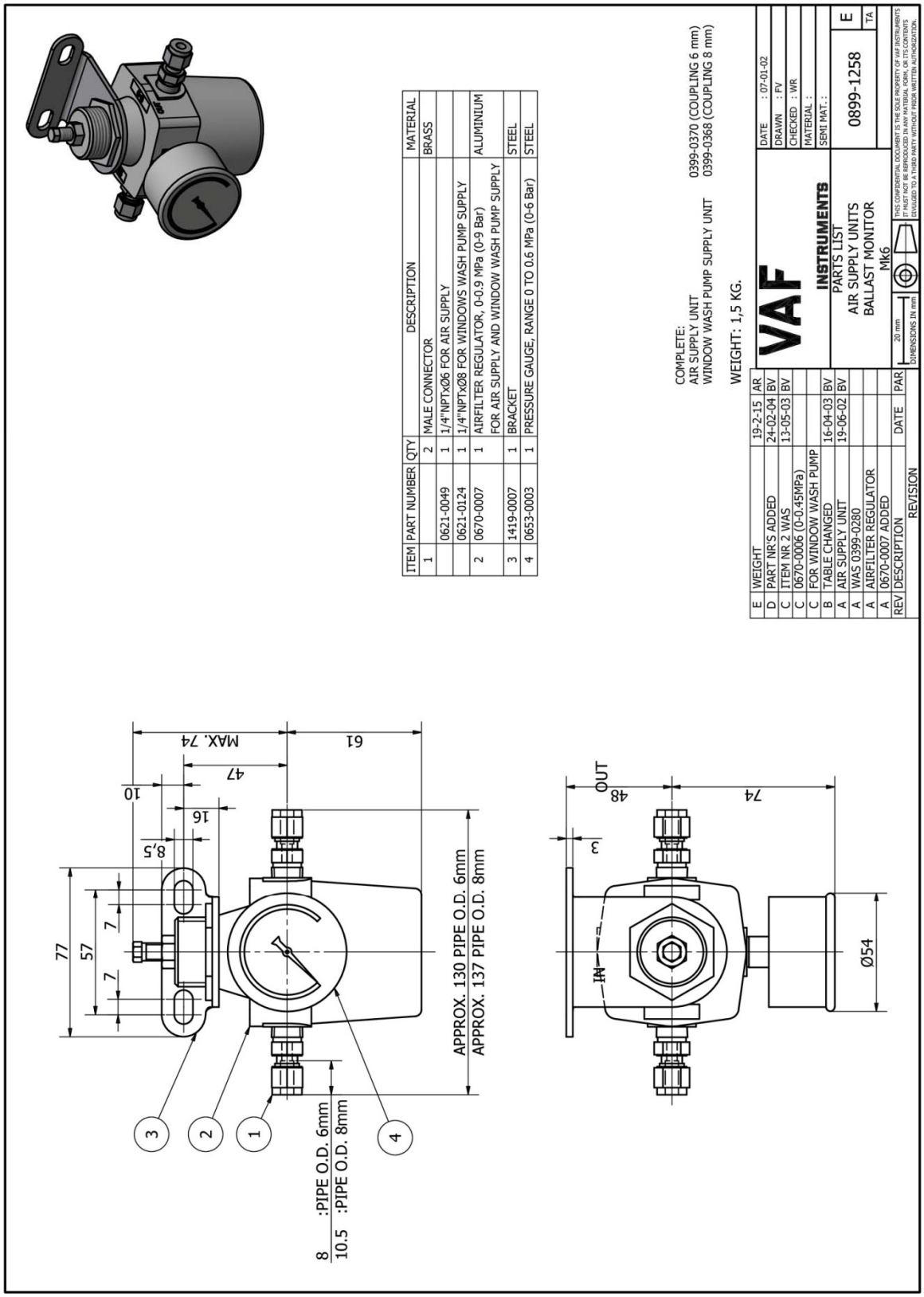
Drawing 37 – 0899-1163



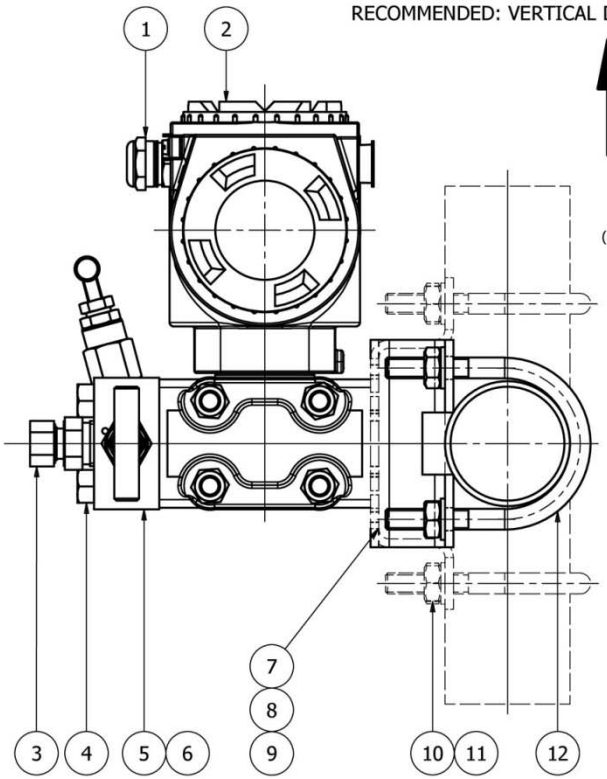
Drawing 38 – 0899-1249

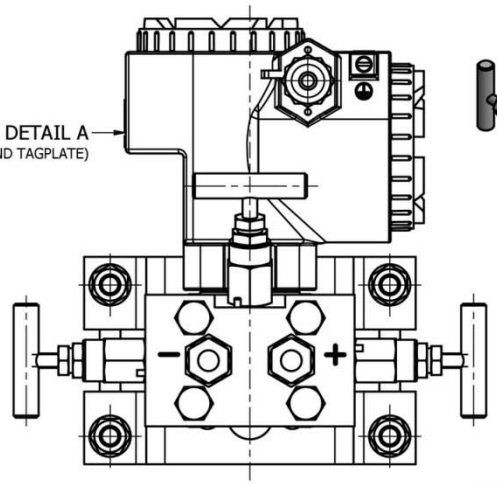


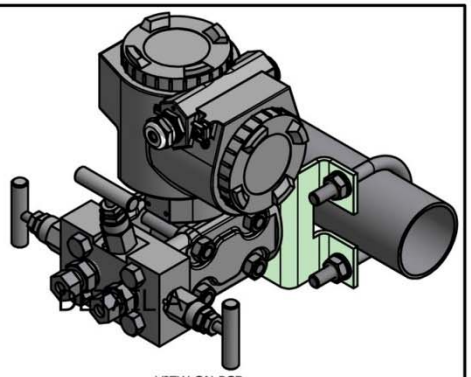
Drawing 39 – 0899-1256

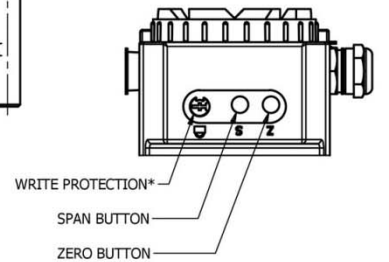


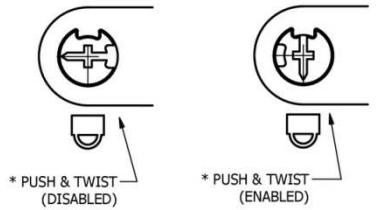
Drawing 40 – 0899-1258











ITEM No.	PART NUMBER	QTY	PART NAME	MATERIAL
1		1	CABLE GLAND EExeII	BRASS
	0646-1269		CABLE DIA 6-12mm	
	0646-1277		CABLE DIA 10-14mm	
2		1	dP/I TRANSMITTER	AISI 316
	0610-0033		STANDARD, MEASURE SPAN 16 TO 160 kPa	AND
				ALUMINIUM
3	0621-0245	2	MALE CONNECTOR 1/2"NPT x 10 mm	AISI 316
4	1629-1145	4	SCREW, HEX. HEAD, 7/16"x20 UNF L=1.75"	STEEL 8.8
5	0675-0103	1	MANIFOLD INCLUDING ITEM No. 4 AND 6	AISI 316
6	V010-0026	2	GASKET Ø24 x Ø18 x 3 mm	TEFLON
7	1629-1119	4	SCREW, HEX. HEAD, 7/16"x20 UNF L=0.75"	STEEL 8.8
8	0716-1100	4	WASHER, PLAIN, 7/16" (M11) DIN 125	STEEL
9	0419-0049	1	BRACKET	STEEL
10	0734-1000	4	NUT, HEX., M10 DIN 934	STEEL 8
11	0716-1000	4	WASHER, PLAIN, M10 DIN 125	STEEL
12	0609-0238	2	U-BOLT FOR 2"PIPE	STEEL

dP/1 TRANSMITTER COMPLETE:

0399-0431 STANDARD, MEASURE SPAN 16 TO 160 kPa.

KIT FOR PIPE MOUNTING:

0319-0018 INCLUDE ITEM; 7, 8, 9, 10, 11 AND 12

0810-2010 EXTERNAL CONNECTION DIAGRAM

0899-1163 DIMENSIONAL DRAWING

REV	DESCRIPTION	DATE	PAR
B	ADDED VIEW OF SET BUTTONS	3-3-16	AR
A	CORR. PART NUMBERS	15-04-15	FV

REVISION

VAF INSTRUMENTS

DATE	: 26-01-15
DRAWN	: FV
CHECKED	: wR
MATERIAL	:
SEMI MAT.	:

PARTS LIST ABB
dP/I TRANSMITTER
FLOW METER KIT
Mark 5/6

0899-1259 B TA

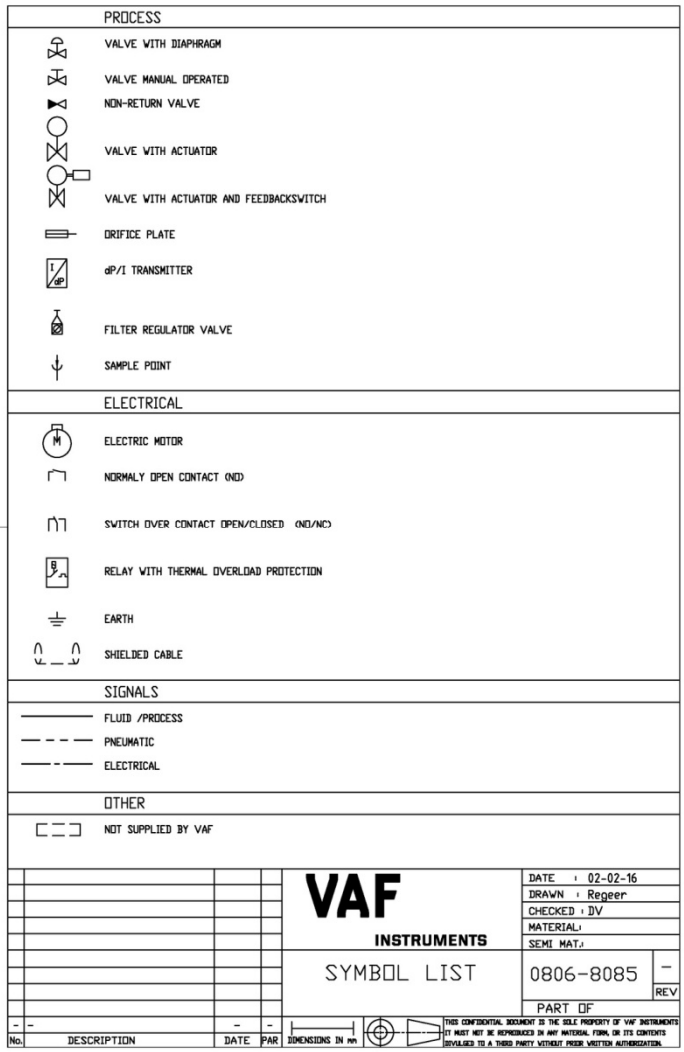
20 mm
DIMENSIONS IN mm

18 ABBREVIATIONS

18.1 ABBREVIATIONS

ATF	Automatic Transmission Fluid
CCR	Cargo Control Room
DPT	Differential Pressure Transmitter
EPU	Electro Pneumatic Unit
GPS	Global Position System
IMO	International Maritime Organization
IOM	Installation, Operation and Maintenance
MCU	Main Control Unit
NO	Normally Open
NC	Normally Closed
MCT	Multi Cable Transit
I/S signal cable	Intrinsically safe signal cable

18.2 SYMBOL LIST



19 SPARE PARTS

19.1 STANDARD SPARES

Standard spare parts supplied with every Oilcon® Oil Discharge Monitoring and Control System delivery:

Description	Stock number	Quantity
Standard spare parts OIL DISCHARGE MONITOR system	**0390-1301**	
O-ring I.D. 53.70 x 1.78 mm		2
Bulkhead seal lubricant		500ml
Cleansing brush		1
Slow fuse 630 mA slow		2

19.2 SERVICING SPARES

When ordering spares, always refer to:

- The Oilcon® Oil Discharge Monitoring and Control System's serial number.
- The required spares indicating: Description of kit, Stock number and Quantity required.

The following spare parts are recommended to be kept on stock:

Description	Stock number	Quantity
Sample pump maintemance kit	**0390-1182**	
See drawing 0806-1260		
Mechanical seal (9)		1
Woodruff key (11)		1
Shim set (4)		1
Hex. Screw (12)		1
O-ring (13)		1
O-ring (8)		1
Coupling (14)		1
Oil sealing (25)		2
Ring (26)		1

Description	Stock number	Quantity
Window wash maintenance kit		
See drawing 0871-1213		
Spare parts kit	**0390-1403**	1
See drawing number for the kit content		

Description	Stock number	Quantity
Electrical items spares kit	**0390-1211**	
LED Green (starter box)		2
LED Red (starter box)		2
Fuses 500 mA slow (EPU)		2
Fuses 630 mA slow (EPU)		2

Other spare parts might be needed occasionally. Please refer to drawings of specific part.

20 WARRANTY CONDITIONS

1. Without prejudice to the restrictions stated hereinafter, the contractor guarantees both the soundness of the product delivered by him and the quality of the material used and/or delivered for it, insofar as this concerns faults in the product delivered which do not become apparent during inspection or transfer test, which the principal shall demonstrate to have arisen within 12 months from delivery in accordance with sub article 1A exclusively or predominantly as a direct consequence of unsoundness of the construction used by the contractor or as a consequence of faulty finishing or the use of poor materials.

   1A. The product shall be deemed to have been delivered when it is ready for inspection (if inspection at the premises of the contractor has been agreed) and otherwise when it is ready for shipment.

2. Articles 1 and 1A shall equally apply to faults which do not become apparent during inspection or transfer test which are caused exclusively or predominantly by unsound assembly/installation by the contractor. If assembly/installation is carried out by the contractor, the guarantee period intended in article 1 shall last 12 months from the day on which assembly/installation is completed by the contractor, with the understanding that in this case the guarantee period shall end not later than 18 months after delivery in accordance with the terms of sub article 1A.

3. Defects covered by the guarantee intended under articles 1, 1A and 2 shall be remedied by the contractor by repair or replacement of the faulty component either on or off the premises of the contractor, or by shipment of a replacement component, this remaining at the discretion of the contractor. Sub article 3A shall equally apply if repair or replacement takes place at the site where the product has been assembled/installed. All costs accruing above the single obligation described in the first sentence, such as are not restricted to shipment costs, travelling and accommodation costs or disassembly or assembly costs insofar as they are not covered by the agreement, shall be paid by the principal.

   3A. If repair or replacement takes place at the site where the product has been assembled/installed, the principal shall ensure, at his own expense and risk, that:
   a. the employees of the contractor shall be able to commence their work as soon as they have arrived at the erection site and continue to do so during normal working hours, and moreover, if the contractor deems it necessary, outside the normal working hours, with the proviso that the contractor informs the principal of this in good time;
   b. suitable accommodation and/or all facilities required in accordance with government regulations, the agreement and common usage, shall be available for the employees of the contractor;
   c. the access roads to the erection site shall be suitable for the transport required;
   d. the allocated site shall be suitable for storage and assembly; the necessary lockable storage sites for materials, tools and other goods shall be available;
   e. the necessary and usual auxiliary workmen, auxiliary machines, auxiliary tools, materials and working materials (including process liquids, oils and greases, cleaning and other minor materials, gas, water, electricity, steam, compressed air, heating, lighting, etc.) and the measurement and testing equipment usual for in the business operations of the principal, shall be available at the correct place and at the disposal of the contractor at the correct time and without charge;
   f. all necessary safety and precautionary measures shall have been taken and adhered to, and all measures shall have been taken and adhered to necessary to observe the applicable government regulations in the context of assembly/installation;
   g. the products shipped shall be available at the correct site at the commencement of and during assembly.

4. Defects not covered by the guarantee are those which occur partially or wholly as a result of:
   a. non-observance of the operation and maintenance instructions or other than foreseeable normal usage;
   b. normal wear and tear;
   c. assembly/installation by third parties, including the principal;
   d. the application of any government regulation regarding the nature or quality of the material used;
   e. materials or goods used in consultation with the principal;
   f. materials or goods provided by the principal to the contractor for processing;
   g. materials, goods, working methods and constructions insofar as are applied at the express instruction of the principal, and materials or goods supplied by or on behalf of the principal;
   h. components obtained from third parties by the contractor insofar as that party has given no guarantee to the contractor.

5. If the principal fails to fulfil any obligation properly or on time ensuing from the agreement concluded between the principal and the contractor or any agreement connected to it, the contractor shall not be bound by any of these agreements to any guarantee regardless of how it is referred to. If, without previous written approval from the contractor, the principal commences disassembly, repair or other work on the product or allows it to be commenced, then every agreement with regard to guarantee shall be void.

6. Claims regarding defects must be submitted in writing as quickly as possible and not later than 14 days after the discovery of such. All claims against the contractor regarding faults shall be void if this term is exceeded. Claims pertaining to the guarantee must be submitted within one year of the valid complaint on penalty of invalidity.

7. If the contractor replaces components/products under the terms of his guarantee obligations, the replaced components/products shall become the property of the contractor.

8. Unless otherwise agreed, a guarantee on repair or overhaul work carried out by the contractor or other services shall only be given on the correctness of the manner in which the commissioned work is carried out, this for a period of 6 months. This guarantee only covers the single obligation of the contractor to carry out the work concerned once again in the event of unsound work. In this case, sub article 3A shall apply equally.

9. No guarantee shall be given regarded the inspection conducted, advice given and similar matters.

10. Alleged failure to comply with his guarantee commitments on the part of the contractor shall not absolve the principal from his obligations ensuing from any agreement concluded with the contractor.

11. No guarantee shall be given on products which form a part of, or on work and services on, goods older than 8 years.

Revision 0712: DNV certificate added
Revision 0812: KEME certificate renewed, IECEx certificate added
Revision 0313: Drawing 0806-2050 corrected
Revision 0413: Chapter 7.2.1.5.2 and 7.2.1.5.4.3: Alarm setting adjustable till 50 ppm
Revision 0214:
Chapter 3.6 table of products re-arranged
Chapter 8.2.1 product added
Chapter 19.1 and 19.2 corrected
Revision 1014: Chapter 7.5 Flow underrange; added only applicable for two flowmeters
Revision 1014(2):
Chapter 16:
EC DECLARATION OF CONFORMITY FOR EQUIPMENT and PROTECTIVE SYSTEMS renewed
Revision 0215:
Updated Chapter 3.6, added Bio-Fuels and removed ANNEX II products.
Added Chapter 3.7, Bio-fuel guidelines and definitions
Updated several text fields for Bio-fuel notations (MEPC.240(65))
Replaced MCT drawing with 0806-8070 RevA
Added drawings 0899-1163 & 0899-1259 from ABB dP/I transmitter
Replaced Window wash pump drawing with 0871-1213
Revision 0615:
Added at Chapter 16.2: Type approval notation for Biofuel blends.
In Chapter 7.2.1.5.2, the table text has been updated for: Speed ind / Flow rate ind / Oil conc. Ind / Display contrast
Chapter 16 DNV-GL EC-Type examination certificate deleted
Revision 0815:
Chapter 16: sub-section changed and listed certificates updated
Chapter 17: p1 31-table and dwg numbering updated

Revision 0216: Chapter 18: Symbol list added

Revision 0416:
Chapter 1.1 Warning added
Chapter 16.1 EU Declaration of conformity for equipment and protective systems renewed

Revision 0616:
Chapter 3: Specifications supplemented: GPS details added, cable glands detailed, wire sizes detailed, in-/output types detailed.
Chapter 6.7.4: Response time calculation updated.
Chapter 8.3: Test and check-out updated according Mark6M, Step 77 “Memory check” added.
Chapter 9.2: Details dwg# etc updated according to latest window wash pump.
Chapter 9.4: dP/I zero/span adjustment description according Fuji dP/I updated and ABB added.
Chapter 17: Drawings updated with latest.
Chapter 19: Spareparts updated with latest.
Overall: Minor (physical)details updated.

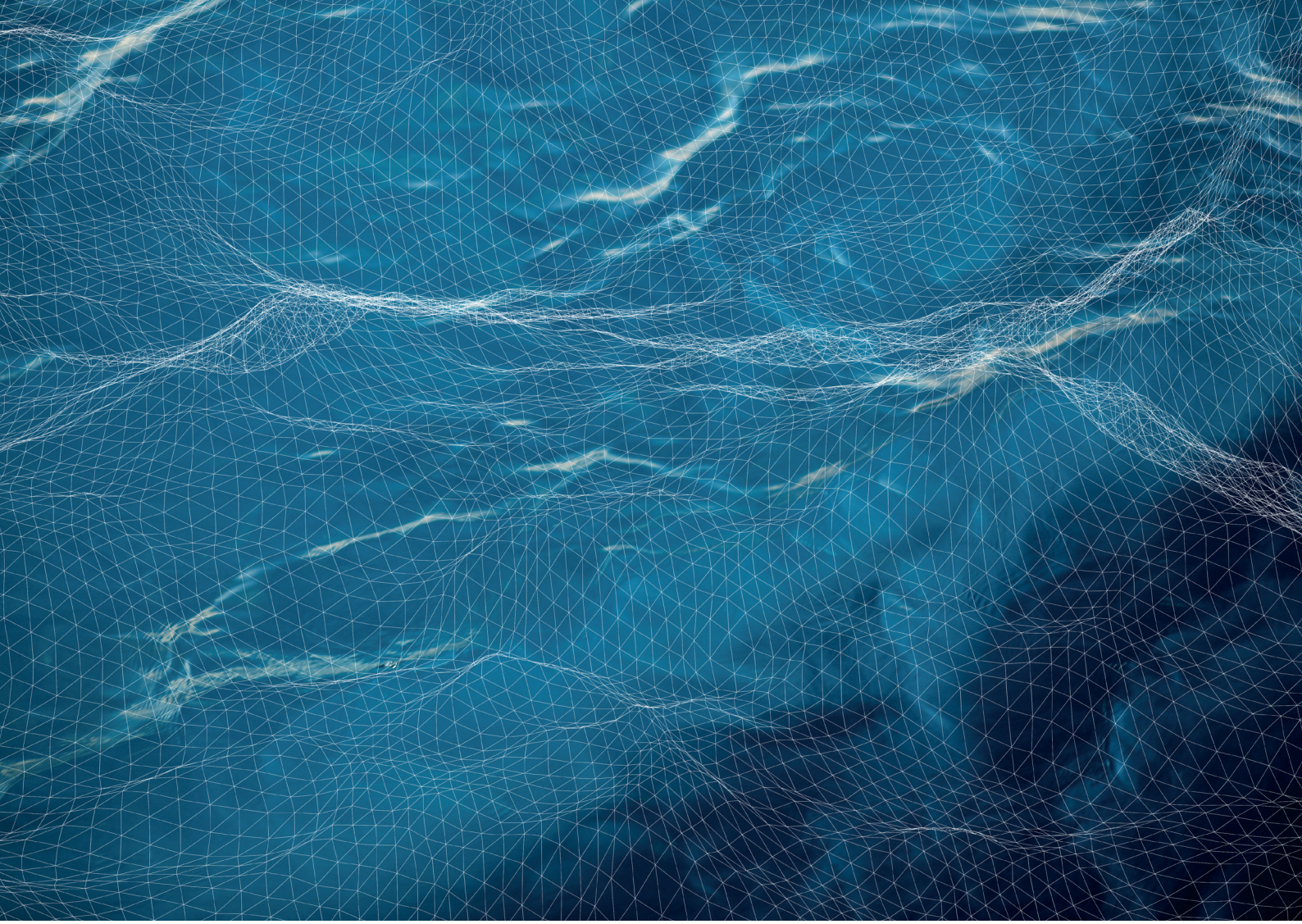
Revision 1216:
Chapter19.2 corrected

Revision 0317:
Chapters 15.2 – 17 and 15.5.1 – 2 clarified

Revision 0617:
Chapter 19.2 applicable spare kits

Revision 1117:
Chapter 7.3 corrected V11 position

Revision 1218:
Chapter 16 ATEX certificates updated



VAF

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